Jeremiah Moore

A

TREATISE

Jeremiah OF Moore

Practical Surveying;

WHICH IS DEMONSTRATED

FROM ITS FIRST PRINCIPLES.

48,924.

WHEREIN

EVERY THING THAT IS USEFUL AND CURIOUS IN THAT ART, IS FULLY CONSIDERED AND EXPLAINED.

PARTICULARLY

THREE NEW AND VERY CONCISE METHODS FOR DETERMINING THE AREAS OF RIGHT-LINED FIGURES ARITHMETICALLY, OR BY CALCULATION, AS WELL AS THE GEOMETRICAL ONES HERETOFORE TREATED OF.

The whole illustrated with Copper-Plates.

THE SIXTH EDITION.

By ROBERT GIBSON, TEACHER *of the* MATHEMATICS.

WITH ALTERATIONS AND AMENDMENTS, ADAPTED TO THE USE OF AMERICAN SURVEYORS.

PHILADELPHIA:

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Advertiſement.

THE preſent publication being chiefly intended for the American reader, we have taken the liberty of making ſome alterations, which, it is preſumed, will rather prove advantageous than otherwiſe.

Some parts of the work have been abridged, and other parts totally omitted, as being of little or no uſe to the American ſurveyor. Theſe alterations have enabled the Editor to introduce into the body of the work, ſome matters of conſiderable importance in the practice of ſurveying; amongſt which, are a complete ſet of tables of latitude and departure, to the diſtance of 100, and to every 15 minutes of the quadrant; alſo an example of calculating the contents of a ſurvey, according to the method commonly practiſed in the ſurveyor general's office in this city.

Philadelphia, 1789.

PREFACE.

THE word *geometry* imports no more than *to meaſure the earth*, or to meaſure land; yet in a larger and more proper ſenſe, it is applied to all ſorts of dimenſions. It is generally ſuppoſed to have had its riſe among the *Egyptians*, from the river *Nile*'s deſtroying and confounding all their land-marks by its annual inundations, which laid them under the neceſſity of inventing certain methods and meaſures to enable them to diſtinguiſh and adjuſt the limits of their reſpective grounds, when the waters were withdrawn. And this opinion is not entirely to be rejected, when we conſider that *Moſes* is ſaid to have acquired this art, when he reſided at the *Egyptian* court. And *Achilles Tatius* in the beginning of his introduction to *Aratus*'s *Phænomena*, informs us, that the *Egyptians* were the firſt who meaſured the heavens and the earth (and of courſe the earth firſt) and that

that their ſcience in this matter, was engraven on columns, and by that means delivered to poſterity.

It is a matter of ſome wonder, that though ſurveying appears to have been the firſt, or at leaſt one of the firſt of the mathematical ſciences, that the reſt have met with much greater improvements from the pens of the moſt eminent mathematicians, while this ſeems to have been neglected; inſomuch that I have not been able to meet with one author, who has ſufficiently explained the whole art in its theory and practice: for the moſt part, it has been treated of in a practical manner only; and the few who have undertaken the theory, have in a great meaſure omitted the practice.

Theſe conſiderations induced me to attempt a methodical, eaſy, and clear courſe of *Surveying*; how far I have ſucceeded in it, muſt be determined by the impartial reader: the ſteps I have taken to render the whole evident and familiar are as follow:

In ſection the firſt, you have decimal fractions, the ſquare root, geometrical definitions, ſome neceſſary theorems and problems; with the nature and uſe of the tables of logarithm numbers, ſigns, tangents, and ſecants.

The

The ſecond ſection contains plane trigonometry right angled and oblique, with its application in determining the meaſures of inacceſſible heights and diſtances.

The third ſection gives an account of the chains and meaſures uſed in *Great-Britain* and *Ireland*, methods of ſurveying and of taking inacceſſible diſtances by the chain only, with ſome neceſſary problems; alſo a particular deſcription of the ſeveral inſtruments uſed in ſurveying, with their reſpective uſes.

The fourth ſection contains two methods of finding the areas of maps from their geometrical conſtruction, more conciſe than any heretofore made public.

The fifth ſection contains a new, and much more conciſe method of determining the areas of ſurveys from the field-notes, or by calculation than any hitherto publiſhed; and I venture to aſſert that it is impoſſible (from the nature of right-lined figures) that any method or methods more conciſe than this, can be inveſtigated.

To theſe methods is annexed a ſhort table of difference of latitude and half departure, to every degree and quarter of a degree of the quadrant, the ſtationary diſtance being one

one chain; which will be found as ready, by a little practice, and perhaps more exact, than thoſe already publiſhed.

Truth calls upon me to acknowledge, that the methods by calculation, herein ſet forth, got their riſe from thoſe of the late *Thomas Burgh*, eſq. who firſt diſcovered an univerſal method for determining the areas of right lined figures, and for which he obtained a parliamentary reward. I hope therefore it cannot be conſtrued as an intention in me to take from his great merit, when I ſay, that the methods herein contained are much more conciſe and ready than his.

Section the ſixth contains the nature of off-ſets, and the method of caſting them up by the pen: the nature and application of enlarging, diminiſhing, and connecting of maps: variation of the compaſs by amplitudes and azimuths, with ſome of its uſes; to which is added, a table of the ſun's declination: how to find by what ſcale a map is laid down, having the map and area given: how to find the content of ground that is ſurveyed by a chain that is too long or too ſhort: the method of dividing lands: And the whole concludes with ſome neceſſary directions and remarks on ſurveys in general.

THE

THE PRINCIPLES OF SURVEYING.

SECT. I.

Containing Decimal Fractions, the Square Root, Geometrical Definitions, Theorems and Problems; with the Nature and Use of the Tables of Logarithm Numbers, Sines, Tangents, and Secants.

DEFINITION.

SURVEYING is that art which enables us to give a plan, or juſt repreſentation, of any piece or parcel of land, and to determine the content thereof, in ſuch meaſure as is agreeable and cuſtomary to the country or place where the land is.

This ſcience depends on ſome parts of the mathematics, which muſt be known before we can treat of it, wherefore we ſhall begin with

DECIMAL FRACTIONS.

If we ſuppoſe unity or any one thing to be divided into any aſſigned number of equal parts, this number is called the denominator; and if we chuſe to take any number of ſuch parts leſs than the whole, this is called the numerator of a fraction.

 The

The numerator, in the vulgar form, is always wrote over the denominator, and theſe are ſeparated by a ſmall line thus $\frac{5}{12}$ or $\frac{7}{12}\begin{smallmatrix}\text{Numerator}\\ \text{Denominator}\end{smallmatrix}$ the firſt of theſe is called 5 twelfths, and the latter 7 twelfths of an inch, yard, perch, *&c.* or of what ever the whole thing originally was.

Fractions are expreſſed in two forms, that is, either vulgarly or decimally.

All fractions whoſe denominators do not conſiſt of a cypher or cyphers ſet after unity, are called vulgar ones, and their denominators are always wrote under their numerators. The treating of theſe would be foreign to our preſent purpoſe. But fractions whoſe denominators conſiſt of an unit prefixed to one or more cyphers, are called decimal fractions; the numerators of which are written without their denominators, and are diſtinguiſhed from integers by a point prefixed: thus $\frac{2}{10}$ $\frac{42}{100}$ and $\frac{172}{1000}$ in the decimal form, are expreſſed by .2 .42 .172.

The denominators of ſuch fractions always conſiſting of an unit, prefixed to as many cyphers as there are places of figures in the numerators, it follows, that any number of cyphers put after thoſe numerators, will neither increaſe or leſſen their value: for $\frac{3}{10}$ $\frac{30}{100}$ and $\frac{300}{1000}$ are all of the ſame value, and will ſtand in the decimal form thus .3 .30 .300; but a cypher or cyphers prefixed to thoſe numerators, leſſen their value in a tenfold proportion: for $\frac{3}{10}$ $\frac{03}{100}$ and $\frac{003}{1000}$ which in the decimal form we denote by .3 .03 and .003, are fractions, of which the firſt is ten times greater than the ſecond; and the ſecond, ten times greater than the third.

Hence it appears, that as the value and denomination of any figure or number of figures in common arithmetic is enlarged, and becomes ten

or

or an hundred, or a thoufand times greater, by placing one or two, or three cyphers after it; fo in decimal arithmetic, the value of any figure or number of figures, decreafes, and becomes ten, or a hundred, or a thoufand times lefs, while the denomination of it increafes, and becomes fo many times greater, by prefixing one, or two, or three cyphers to it: and that any number of cyphers, before an integer, or after a decimal fraction, has no effect in changing their values.

Integers.							Decimals.					
1	2	7	1	6	3	.	5	1	2	3	6	7
Hund. of thouf.	Tens of thouf.	Thoufands	Hundreds	Tens	Units		Tenths	Pts. of a hund.	Pts. of a thouf.	Pts. of ten thouf.	Pts. of hun. tho.	Pts. of a million

Addition of DECIMALS.

Having placed thofe figures which are equi-diftant from the point, (as well integers as fractions) under each other, add them as if they were integers.

EXAMPLES.

Add 4.7832 3.2543 7.8251 6.03 2.857 and 3.251 together. Place them thus,

```
        4.7832
        3.2543
        7.8251
        6.03
        2.857
        3.251
        -------
Anfwer 28.0006
```

Add

Add 6.2 121.306 .75 2.7 and .0007 together.

```
         121.306
             .75
            2.7
            .0007
         ________
Anfwer   130.9567
         ________
```

What's the fum of 6.57 1.026 .75 146.5 8.7 526. 3.97 and .0271?
Anfwer 693.5431.

What's the fum of 4.51 146.071 .507 .0006 132. 62.71 .507 7.9 and .10712?
Anfwer 354.31272.

Subtraction of DECIMALS.

Having placed the figures which are equidiftant from the point, under each other; deduct as if they were integers.

EXAMPLES.

```
From     38.765 take 25.3741
         25.3741
         _______
Anfwer   13.3909
         _______
```

```
From  2.4 take .8472
           .8472
          ______
          1.5528
          ______
```

From 71.45 take 8.4837248
Anfwer 62.9662752.

From

From 84 take 82.3412
Anſwer 1.6588

Multiplication of DECIMALS.

Place the multiplicand and multiplier, after any manner under each other; and having multiplied as in whole numbers, cut off as many places of decimals in the product, counting from the right hand towards the left, as there are in the multiplicand, and multiplier: but if there be not a ſufficient number of places in the product, the defect may be ſupplied, by prefixing cyphers thereto.

For the denominator of the product, being an unit, prefixed to as many cyphers, as the denominators of the multiplier and multiplicand contain of cyphers, it follows, that the places of decimals in the product, will be as many as in the numbers from whence it aroſe.

EXAMPLES.

Multiply 48.765 by .003609
.003609

438885
292590
146295

Anſwer .175992885

Multiply .121
by .14

484
121

Anſwer .01694

Multiply

Multiply 121.6 by 2.76

```
        2.76
      ------
        7296
       8512
      2432
      ------
Anſwer 335.616
      ------
```

Multiply .0089789 by 1085
Anſwer 9.7421065

Multiply .248723 by .13587
Anſwer .03379399401

Diviſion of DECIMALS.

Having divided as in whole numbers, annexing cyphers to the dividend if they be wanted; the decimal places in the diviſor and quotient muſt be equal to thoſe in the dividend, and the defect ſupplied by prefixing cyphers to the quotient.

For the dividend is a product, contained under the diviſor and quotient; and that product contains as many places of decimals as the numbers do from whence it aroſe: therefore, the difference between the number of decimals in the dividend and diviſor, muſt be cut off in the quotient.

EXAMPLES.

Divide .144 by .12

```
.12).144( 1.2
      ---
       24
      ---
```

Divide

Divide 63.72413456922 by 2718

2718)63.72413456922(.02344522979

9364

12101

12293

14214

6245

8096

26609

21472

24462

. . . . .

Answer .02344522979

There being 11 decimal figures in the dividend, and none in the divisor, 11 figures are to be cut off in the quotient; but as the quotient itself consists of but 10 figures, we prefix to them a cypher to compleat that number.

Divide 1.728 by .012

.012)1.728(144

52

48

Because

Becauſe the number of decimal figures in the diviſor and dividend, are alike, the quotient will be integers.

Divide 2.00000 by 3.1416

```
3.1416)2.000000(.636618
        115040
         207920
          194240
           57440
           260240
             8912
```

There being 4 decimal figures in the diviſor, and 10 including the cyphers brought down in the dividend, the difference, which is 6 figures, to be cut off in the quotient.

Divide 87446071 by .004387.
Anſwer 199.33.
Divide .624672 by 482.
Anſwer .001296.
Divide 66.993548 by 27.4.
Anſwer 2.44502.

PROB. I.

To reduce a Vulgar Fraction to a Decimal one of the ſame Value.

Having annexed a ſufficient number of cyphers as decimals, to the numerator of the vulgar fraction, divide by the denominator; and the quotient thence ariſing, will be the decimal fraction required.

EXAM-

EXAMPLES.

Reduce $\frac{3}{4}$ to a decimal fraction.

4)3.00(.75 Anfwer.

20

For $\frac{3}{4}$ of one fhilling, yard, perch, &c. is equal to one fourth of three fhillings, yards, perches, &c. therefore if 3 be divided by 4, the quotient will be the anfwer.

Reduce $\frac{2}{5}$ to a decimal fraction.

5)2.0(.4 Anfwer.

Reduce $\frac{12}{25}$ to a decimal fraction.

25)12.00(.48 Anfwer.

200

Reduce $\frac{25}{218}$ to a decimal fraction.

Anfwer .1146789.

PROB. II.

To find the Value of a Decimal Fraction, in the known Parts of the Integer.

Multiply the decimal propofed, into the number of equal parts contained in the integer, and the product will be the number of fuch parts as are expreffed by the fraction.

What's the value of .25 of a pound fterling?

20

Anfwer fhillings 5.00

For .25 or $\frac{25}{100}$ of one pound, is equal to the one hundredth part of 25 pounds, or of the ſhillings in 25 pounds, which are 500; therefore the one hundredth part thereof will be 5 ſhillings; which is effected by cutting off the two cyphers, for the two decimals, by a point.

What's the value of .385 of a pound ſterling?

	.385
	20
Shillings	7.700
	12
Pence	8.400
	4
Farthings	1.600

What's the value of .48 of a chain of 50 links?

	.48
	50
Anſwer, links	24.00

What's the value of .2864 of a ſhilling?

	.2864
	12
Pence	3.4368
	4
Farthings	1.7472

What's the value of .287 of a pound weight troy?

	Oz.	dwt.	gr.
Anſwer	3	8	21

What's

What's the value of .2945 of a pound avoirdupoise?

	Oz.	dwt.
Answer	4	11¼

The EXTRACTION of the SQUARE ROOT.

A SQUARE number is the product of a number multiplied by itself; and the number so multiplied, is called the root of that square; thus 9 is the square of 3, and 3 is the root of 9, for 3 multiplied by 3 is 9.

If a square number be given to find its root, observe if the number of figures or places in the given square be odd or even, if they be odd, find the root of the first figure; but if they be even, of the two first; under which place the square of that root, and deduct, placing the root in the quotient, and bring down two figures to the remainder.

Let the double of the said root be made a divisor to all the figures of that last remainder, except the last; put the quotient thereof with the root, or former quotient; and having multiplied it into the numbers so formed, deduct the product from the foregoing figures or resolvend: and in like manner proceed, till all the figures of the given square are exhausted.

If there be any decimals in the given square, their number must be even, or made so, before we begin to find the root, by adding a cypher to the right hand; and for every two places of decimals in the square, let one be cut off in the root.

EXAM-

EXAMPLES.

1. What's the ſquare root of this ſquare number, 298116?

```
    29,81,16(546
    25
   ————
  104)481
       416
      ————
 1086).6516
       6516
      ————
       ....
```

Becauſe the number of figures in the given ſquare number is even, we find the neareſt ſquare number to the two firſt figures 29, which is 25, the root whereof, 5, we ſet in the quotient, and deduct 25 from 29, and to the reſidue 4, we annex the following figures, 81, ſo we have 481 for a reſolvend.

The double of the firſt figure in the quotient being 10, is then ſet as a diviſor to 48, all the figures in the reſolvend, but the laſt; and finding it to be contained 4 times, we annex the 4 to the diviſor and quotient; the then diviſor, 104, is multiplied by the laſt figure in the quotient 4, and the product 416 is deducted from the reſolvend 481, to the reſidue whereof is annexed the two following figures in the ſquare, ſo we have 6516 for a new reſolvend, to all which figures but the laſt we make 108, the double of 54, the figures in the quotient a diviſor, and finding it will be contained 6 times, we place 6 in the diviſor and quotient; the then diviſor 1086 is multiplied by the laſt figure in the quotient 6, and the product being ſet under the reſolvend and thence

thence deducted, leaves nothing: ſo is 546 the root ſought.

For if the root 546 be ſquared or multiplied by 546, the product will be the ſquare number given.

2. What is the ſquare root of 1710864?

```
                 Root.
  1,71,08,64(1308 Anſwer.
  1

 23).71
     69

2608).20864
      20864

      .....
```

What is the ſquare root of 3857.3?

Here being an odd decimal figure, we annex any odd number of cyphers to make the decimal places even; and then extracting the root as before, we thence cut off half the number of decimals that we have in the ſquare. Thus,

```
                  Root.
  3857.300000(62.107 Anſwer.
  36

122)257
    244

1241)1330
     1241

124207) 890000
        869449

        .20551
```

If

If to the ſquare of this root we add the remaining figures 20551, we ſhall have our given ſquare, whoſe root was required.

What is the ſquare root of 16007.3104?
Anſwer 126.52.

What is the ſquare root of 348.17320836?
Anſwer 18.6594.

What is the ſquare root of 12345678987654321?
Anſwer 111111111.

The application of this will hereafter be ſhewn.

THE

THE ELEMENTS OF PLANE GEOMETRY.

DEFINITIONS.

Plate I.

GEOMETRY is that ſcience wherein we conſider the properties of magnitude.

2. A point is that which has no parts, being of itſelf indiviſible, as A.

3. A line has length but no breadth, as AB. figures 1 and 2.

4. The extremities of a line are points, as the extremities of the line AB are the points A and B. figures 1 and 2.

5. A right line is the ſhorteſt that can be drawn between any two points, as the line AB. fig. 1. but if it be not the ſhorteſt, it is then called a curve line, as AB. fig. 2.

6. A

Plate I.

6. A ſuperficies or ſurface is conſidered only as having length and breadth, without thickneſs, as ABCD. fig. 3.

7. The extremities of a ſuperficies are lines.

8. The inclination of two lines meeting one another (provided they do not make one continued line) or the opening between them, is called an angle. Thus fig. 4. the inclination of the line AB to the line BC meeting each other in the point B, or the opening of the two lines BA and BC, is called an angle, as ABC.

Note, When an angle is expreſſed by three letters, the middle one is that at the angular point.

10. When the lines that form the angle are right ones, it is then called a right-lined angle, as ABC. fig. 4. If one of them be right and the other curved, it is called a mix'd angle, as B. fig. 5. If both of them be curved it is called a curved-lined or a ſpherical angle, as C. fig. 6.

11. If a right line, CD (fig. 7) fall upon another right line, AB, ſo as to incline to neither ſide, but make the angles ADC, CDB on each ſide equal to each other, then thoſe angles are called right angles, and the line CD a perpendicular.

12. An obtuſe angle is that which is wider or greater than a right one, as the angle ADE. fig. 7. and an acute angle is leſs than a right one, as EDB. fig. 7.

13. Acute

Plate I.

13. Acute and obtufe angles in general are called oblique angles.

14. If a right line CB. (fig. 8.) be faftened at the end C, and the other end B, be carried quite round, then the fpace comprehended is called a circle; and the curve line defcribed by the point B, is called the circumference or the periphery of the circle; the fixed point C is called its center.

15. The defcribing line CB. (fig. 8.) is called the femidiameter or radius, or any line from the center to the circumference: whence all radii of the fame or of equal circles are equal.

16. The diameter of a circle is a right line drawn thro' the center, and terminating on either fide of the circumference; and it divides the circle and circumference into two equal parts called femicircles; and is double the radius, as AB or DE. fig. 8.

18. The circumference of every circle is fuppofed to be divided into 360 equal parts called degrees, and each degree into 60 equal parts called minutes, and each minute into 60 equal parts called feconds, and thefe into thirds, fourths, &c. thefe parts being greater or lefs as the radius is.

19. A chord is a right line drawn from one end of an arc or arch (that is, any part of the circumference of a circle) to the other; and is the meafure of the arc. Thus the right line HG, is the meafure of the arc HBG. fig. 8.

20. The fegment of a circle is any part thereof, which is cut off by a chord: thus the fpace which is comprehended between the chord HG

Plate I.

and the arc HBG, or that which is comprehended between the ſaid chord HG and the arc HDAEG are called ſegments. Whence 'tis plain, fig. 8.

1. That any chord will divide the circle into two ſegments.

2. The leſs the chord is, the more unequal are the ſegments.

3. When the chord is greateſt it becomes a diameter, and then the ſegments are equal; and each ſegment is a ſemicircle.

21. A ſector of a circle is a part thereof leſs than a ſemicircle, which is contained between two radii and an arc: thus the ſpace contained between the two radii CH, CB, and the arc HB is a ſector. Fig. 8.

22. The right ſine of an arc, is a perpendicular line let fall from one end thereof, to a diameter drawn to the other end: thus HL is the right ſine of the arc HB.

The ſines on the ſame diameter increaſe till they come to the center, and ſo become the radius: hence it is plain that the radius CD is the greateſt poſſible ſine, and thence is called the whole ſine.

Since the whole ſine CD (fig. 8.) muſt be perpendicular to the diameter (by def. 22.) therefore producing DC to E the two diameters AB and DE croſs one another at right angles, and thus the periphery

Plate I.

periphery is divided into four equal parts, as BD, DA, AE, and EB; (by def. 11.) and ſo BD becomes a quadrant or the fourth part of the periphery: therefore the radius DC is always the ſine of a quadrant, or of the fourth part of the circle BD.

Sines are ſaid to be of as many degrees as the arc contains parts of 360: ſo the radius being the ſine of a quadrant becomes the ſine of 90 degrees, or the fourth part of the circle, which is 360 degrees.

23. The verſed ſine of an arc is that part of the diameter that lies between the right ſine and the circumference: thus LB is the verſed ſine of the arc HB. fig. 8.

24. The tangent of an arc is a right line touching the periphery, being perpendicular to the end of the diameter, and is terminated by a line drawn from the center thro' the other end: thus BK is the tangent of the arc HB. fig. 8.

25. And the line which terminates the tangent, that is, CK, is called the ſecant of the arc HB. fig. 8.

26. What an arc wants of a quadrant is called the complement thereof: thus DH is the complement of the arc HB.

27. And what an arc wants of a ſemicircle is called the ſupplement thereof: thus AH is the ſupplement of the arc HB. fig. 8.

28. The

Plate I.

28. The ſine, tangent, or ſecant of the complement of any arc, is called the co-ſine, co-tangent, or co-ſecant of the arc itſelf: thus FH is the ſine, DI the tangent, and CI the ſecant of the arc DH; or they are the co-ſine, co-tangent, or co-ſecant of the arc HB. fig. 8.

29. The ſine of the ſupplement of an arc, is the ſame with the ſine of the arc itſelf; for drawing them according to def. 22, there reſults the ſelf-ſame line; thus HL is the ſine of the arc HB, or of its ſupplement ADH. fig. 8.

30 The meaſure of a right-lined angle, is the arc of a circle ſwept from the angular point, and contained between the two lines that form the angle: thus the angle HCB (fig. 8.) is meaſureed by the arc HB, and is ſaid to contain ſo many degrees as the arc HB does; ſo if the arc HB is 60 degrees, the angle HCB is an angle of 60 degrees.

Hence angles are greater or leſs according as the arc deſcribed about the angular point, and terminated by the two legs, contain a greater or leſs number of degrees of the whole circle.

31. The ſine, tangent, and ſecant of an arc, is alſo the ſine, tangent, and ſecant of an angle whoſe meaſure the arc is; thus becauſe the arc HB is the meaſure of the angle HCB, and ſince HL is the ſine, BK the tangent, and CK the ſecant, BL the verſed ſine, HF the co-ſine, DI the co-tangent, and CI the co-ſecant, &c. of the arc BH; then HL is called the ſine, BK the tangent,

Plate I.

tangent, CK the ſecant, &c. of the angle HCB. whoſe meaſure is the arc HB. fig. 8.

32. Parallel lines are ſuch as are equidiſtant from each other, as AB, CD. fig. 9.

33. A figure is a ſpace bounded by a line or lines. If the lines be right it is called a recti-lineal figure, if curved it is called a curvilineal figure; but if they be partly right and partly curved lines, it is called a mixt figure.

34. The moſt ſimple rectilineal figure is a triangle, being compoſed of three right lines, and is conſidered in a double capacity; 1ſt, with reſpect to its ſides; and 2d, to its angles.

35. In reſpect to its ſides it is either equilateral, having the three ſides equal, as A. fig. 10.

36. Or iſoſceles, having two equal ſides, as B. fig. 11.

37. Or ſcalene, having the three ſides unequal, as C. fig. 12.

38. In reſpect to its angles, it is either right-angled, having one right angle, as D. fig. 13.

39. Or obtuſe angled, having one obtuſe angle, as E. fig. 14.

40. Or acute angled, having all the angles acute, as F. fig. 15.

41. Acute

Plate I.

41. Acute and obtuse angled triangles are in general called oblique angled triangles, in all which any side may be called the base, and the other two the sides.

42. The perpendicular height of a triangle is a line drawn from the vertex to the base perpendicularly: thus if the triangle ABC, be proposed, and BC be made its base, then if from the vertex A the perpendicular AD be drawn to BC, the line AD will be the height of the triangle ABC, standing on BC as its base. Fig. 16.

Hence all triangles between the same parallels have the same height, since all the perpendiculars are equal from the nature of parallels.

43. Any figure of four sides is called a quadrilateral figure.

44. Quadrilateral figures whose opposite sides are parallel, are called parallelograms: thus ABCD is a parallelogram. Fig. 3. 17. and AB. fig. 18. and 19.

45. A parallelogram whose sides are all equal and angles right, is called a square, as ABCD. fig. 17.

46. A parallelogram whose opposite sides are equal and angles right, is called a rectangle or an oblong, as ABCD. fig. 3.

47. A rhombus is a parallelogram of equal sides, and has its angles oblique, as A. fig. 18. and is an inclined square.

48. A

Plate I.

48. A rhomboides is a parallelogram whoſe oppoſite ſides are equal and angles oblique; as B. fig. 19. and may be conceived as an inclined rectangle.

49. Any quadrilateral figure that is not a parallelogram, is called a trapezium. Plate 7. fig. 3.

50. Figures which conſiſt of more than four ſides are called polygons; if the ſides are all equal to each other, they are called regular polygons. They ſometimes are named from the number of their ſides, as a five-ſided figure is called a pentagon, one of ſix ſides as hexagon, *&c.* but if their ſides are not equal to each other, then they are called irregular polygons, as an irregular pentagon, hexagon, *&c.*

51. Four quantities are ſaid to be in proportion when the product of the extremes is equal to that of the means: thus if A multiplied by D, be equal to B multiplied by C, then A is ſaid to be to B as C is to D.

POSTULATES or PETITIONS.

1. That a right line may be drawn from any one given point to another.

2. That a right line may be produced or continued at pleaſure.

3. That from any center and with any radius, the circumference of a circle may be deſcribed.

4. It is alſo required that the equality of lines and angles to others given, be granted as poſſible: that

that it is poſſible for one right line to be perpendicular to another, at a given point or diſtance; and that every magnitude has its half, third, fourth, &c. part.

Note, Though theſe poſtulates are not always quoted, the reader will eaſily perceive where, and in what ſenſe they are to be underſtood.

AXIOMS or ſelf-evident TRUTHS.

1. Things that are equal to one and the ſame thing, are equal to each other.

2. Every whole is greater than its part.

3. Every whole is equal to all its parts taken together.

4. If to equal things, equal things be added, the wholes will be equal.

5. If from equal things, equal things be deducted, the remainders will be equal.

6. If to or from unequal things, equal things be added or taken, the ſums or remainders will be unequal.

7. All right angles are equal to one another.

8. If two right lines not parallel, be produced towards their neareſt diſtance, they will interſect each other.

9. Things which mutually agree with each other, are equal.

NOTES.

A theorem is a propoſition, wherein ſomething is propoſed to be demonſtrated.

A problem is a propoſition, wherein ſomething is to be done or effected.

A lemma is ſome demonſtration, previous and neceſſary, to render what follows the more eaſy.

A corollary is a conſequent truth, deduced from a foregoing demonſtration.

A ſcholium, is a remark or obſervation made upon ſomething going before.

The Signification of SIGNS.

The ſign =, denotes the quantities between which it ſtands to be equal.

The ſign +, denotes the quantity it precedes to be added.

The ſign —, denotes the quantity which it precedes to be ſubtracted.

The ſign ×, denotes the quantities between them to be multiplied into each other.

To denote that four quantities, A, B, C, D, are proportional, they are uſually written thus, A : B :: C : D; and read thus, as A is to B, ſo is C to D; but when three quantities A, B, C, are proportional, the middle quantity is repeated, and they are written A : B :: B : C.

GEOMETRICAL THEOREMS.

THEOREM I.

Plate I.

IF a right line falls on another, as AB, or EB, does on CD, (fig. 20.) it either makes with it two right angles, or two angles equal to two right angles.

1. If AB be perpendicular to CD, then (by def. 11.) the angles CBA, and ABD, will be each a right angle.

2. But if EB fall ſlantwiſe on CD, then are the angles DBE + EBC=DBE + EBA (=DBA) + ABC, or to two right angles. Q. E. D.

Corollary 1. Whence if any number of right lines were drawn from one point, on the ſame ſide of a right line; all the angles made by theſe lines will be equal to two right angles.

2. And all the angles which can be made about a point, will be equal to four right angles.

THEO.

THEO. II.

Plate I.

If one right line cross another, (as AC does BD) the opposite angles made by those lines, will be equal to each other: that is AEB to CED and BEC to AED. fig. 21.

By theorem 1. BEC + CED = 2 right angles.
and CED + DEA = 2 right angles.

Therefore (by axiom 1.) BEC + CED = CED + DEA: take CED from both, and there remains BEC = DEA. (by axiom 5.) Q. E. D.

After the same manner CED + AED = 2 right angles; and AED + AEB = 2 right angles; wherefore taking AED from both, there remains CED = AEB. Q. E. D.

THEO. III.

If a right line cross two parallels, as GH does AB and CD. (fig. 22.*) then,*

1. *Their external angles are equal to each other, that is GEB = CFH.*

2. *The alternate angles will be equal, that is AEF = EFD and BEF = CFE.*

3. *The external angle will be equal to the internal and opposite one on the same side, that is GEB = EFD and AEG = CFE.*

4. *And*

Plate I.

4. *And the ſum of the internal angles on the ſame ſide, are equal to two right angles; that is, BEF + DFE are equal to two right angles, and AEF + CFE are equal to two right angles.*

1. Since AB is parallel to CD, they may be conſidered as one broad line, croſſed by another line, as GH; (then by the laſt theo.) GEB = CFH, and AEG = HFD.

2. Alſo GEB = AEF, and CFH = EFD; but GEB = CFH (by part 1. of this theo.) therefore AEF = EFD. The ſame way we prove FEB = EFC.

3. AEF = EFD; (by the laſt part of this theo.) but AEF = GEB (by theo. 2.) Therefore GEB = EFD. The ſame way we prove AEG = CFE.

4. For ſince GEB = EFD, to both add FEB, then (by axiom 4.) GEB + FEB = EFD + FEB, but GEB + FEB, are equal to two right angles (by theo. 1.) Therefore EFD + FEB are equal to two right angles: after the ſame manner we prove that AEF + CFE are equal to 2 right angles. Q. E. D.

THEO. IV.

In any triangle ABC, one of its legs, as BC, being produced towards D, it will make the external angle ACD equal to the two internal oppoſite angles taken together. Viz. to B and A fig. 23.

Thro'

Plate I.

Thro' C, let CE be drawn parallel to AB; then ſince BD cuts the two parallel lines BA, CE; the angle ECD = B, (by part 3. of the laſt theo.) and again, ſince AC cuts the ſame parallels, the angle ACE = A (by part 2. of the laſt.) Therefore ECD + ACE = ACD = B + A. Q. E. D.

THEO. V.

In any triangle ABC, all the three angles taken together are equal to two right angles, viz. A + B + ACB = 2 right angles. Fig. 23.

Produce BC to any diſtance, as D, then (by the laſt) ACD = B+A; to both add ACB; then ACD + ACB = A + B + ACB: but ACD + ACB = 2 right angles (by theo. 1.); therefore the three angles A + B + ACB = 2 right angles. Q. E. D.

Cor. 1. Hence if one angle of a triangle be known, the ſum of the other two is alſo known: for ſince the three angles of every triangle contain two right ones, or 180 degrees, therefore 180 —the given angle will be equal to the ſum of the other two; or 180—the ſum of two given angles, gives the other one.

Cor. 2. In every right-angled triangle, the two acute angles are = 90 degrees, or to one right angle: therefore 90 — one acute angle, gives the other.

THEO.

Plate I.

THEO. VI.

If in any two triangles, ABC, DEF, there be two ſides AB, AC in the one, ſeverally equal to DE, DF in the other, and the angle A contained between the two ſides in the one, equal to D in the other; then the remaining angles of the one, will be ſeverally equal to thoſe of the other, viz. B = E and C = F: and the baſe of the one BC, will be equal to EF, that of the other. Fig. 24.

If the triangle ABC be ſuppoſed to be laid on the triangle DEF, ſo as to make the points A and B coincide with D and E, which they will do, becauſe AB = DE (by the hypotheſis); and ſince the angle A = D, the line AC will fall along DF, and inaſmuch as they are ſuppoſed equal, C will fall in F; ſeeing therefore the three points of one coincide with thoſe of the other triangle, they are manifeſtly equal to each other; therefore the angle B = E and C = F, and BC = EF. Q. E. D.

LEMMA.

If two ſides of a triangle a b c be equal to each other, that is ac = cb; the angles which are oppoſite to thoſe equal ſides, will alſo be equal to each other; viz. a = b. fig. 11.

For let the triangle a b c be divided into two triangles a c d, d c b, by making the angle a c d = dcb (by poſtulate 4.) then becauſe a c = b c, and c d common, (by the laſt) the triangle a d c = d c b; and therefore the angle a = b. Q. E. D.

Cor.

Plate I.

Cor. Hence if from any point in a perpendicular which bifects a given line, there be drawn right lines to the extremities of the given one, they with it will form an ifofceles triangle.

THEO. VII.

The angle BCD at the center of a circle ABED, is double the angle BAD at the circumference, ftanding upon the fame arc BED. fig. 25.

Through the point A, and the center C, draw the line ACE: then the angle ECD = CAD + CDA; (by theo. 4.) but fince AC = CD being radii of the fame circle, it is plain (by the preceding lemma) that the angles fubtended by them will be alfo equal, and that their fum is double to either of them, that is, DAC + ADC is double to CAD, and therefore ECD is double to CAD; after the fame manner BCE is double to CAB, wherefore, BCE + ECD, or BCD is double to BAC + CAD or to BAD. Q. E. D.

Cor. 1. Hence an angle at the circumference is meafured by half the arc it fubtends or ftands on.

Cor. 2. Hence all angles at the circumference of a circle which ftand on the fame chord as AB, are equal to each other, for they are all meafured by half the arc they ftand on, *viz.* by half the arc AB. fig. 26.

Cor.

Plate I.

Cor. 3. Hence an angle in a ſegment greater than a ſemicircle is leſs than a right angle; thus ADB is meaſured by half the arc AB, but as the arc AB is leſs than a ſemicircle, therefore half the arc AB, or the angle ADB is leſs than half a ſemicircle, and conſequently leſs than a right angle. Fig. 26.

Cor. 4. An angle in a ſegment leſs than a ſemicircle, is greater than a right angle, for ſince the arc AEC is greater than a ſemicircle, its half, which is the meaſure of the angle ABC, muſt be greater than half a ſemicircle, that is greater than a right angle. Fig. 27.

Cor. 5. An angle in a ſemicircle is a right angle, for the meaſure of the angle ABD, is half of a ſemicircle AED, and therefore a right angle. Fig. 28.

THEO. VIII.

If from the center C of a circle ABE, there be let fall the perpendicular CD on the chord AB, it will biſect it in the point D. fig. 29.

Let the lines CA and CB be drawn from the center to the extremities of the chord, then ſince CA = CB, the angle CAB = CBA (by the lemma.) But the triangles ADC, BDC are right angled ones, ſince the line CD is a perpendicular; and ſo the angle ACD = DCB; (by cor. 2. theo. 5.) then have we AC, CD, and the angle ACD in one triangle; ſeverally equal to CB, CD, and the angle BCD in the other: therefore (by theo. 6.) A = DB. Q. E. D.

So

Plate I.

Cor. Hence it follows, that any line biſecting a chord at right angles, is a diameter; for a line drawn from the center perpendicular to a chord, biſects that chord at right angles; therefore, converſely, a line biſecting a chord at right angles muſt paſs through the center, and conſequently be a diameter.

THEO. IX.

If from the center of a circle ABE there be drawn a perpendicular CD on the chord AB, and produced till it meets the circle, in F, that line CF, will biſect the arc AB in the point F. fig. 29.

Let the lines AF and BF be drawn, then in the triangles ADF, BDF; AD = BD (by the laſt;) DF is common, and the angle ADF = BDF being both right, for CD or DF is a perpendicular. Therefore (by theo. 6.) AF = FB; but in the ſame circle, equal lines are chords of equal arcs, ſince they meaſure them (by def. 19.); whence the arc AF = FB, and ſo AFB is biſected in F, by the line CF.

Cor. Hence the ſine of an arc is half the chord of twice that arc. For AD is the ſine of the arc AF, (by def. 22.) AF is half the arc, and AD half the chord AB (by theo. 8.) therefore the cor. is plain.

THEO. X.

Plate I.

In any triangle ABD, the half of each ſide is the ſine of the oppoſite angle. Fig. 30.

Let the circle ADB be drawn thro' the points A, B, D; then the angle DAB is meaſured by half the arc BKD, (by cor. 1. theo. 7.) *viz.* the chord of BK is the meaſure of the angle BAD; therefore (by cor. to the laſt) BE the half of BD is the ſine of BAD: the ſame way may be proved, that half of AD is the ſine of ABD, and the half of AB the ſine of ADB. Q. E. D.

THEO. XI.

If a right line GH cut two other right lines AB, CD, ſo as to make the alternate angles AEF, EFD equal to each other, then the lines AB and CD will be parallel. Fig. 22.

If it be denied that AB is parallel to CD, let IK be parallel to it; then IEF = (EFD) = AEF (by part 2. theo. 3.) a greater to a leſs, which is abſurd, whence IK is not parallel; and the like we can prove of all other lines but AB; therefore AB is parallel to CD. Q. E. D.

THEO. XII.

If two equal and parallel lines AB, CD, be joined by two other lines AD, BC, thoſe ſhall be alſo equal and parallel. Fig. 3.

Let

Plate I.

Let the diameter or diagonal BD be drawn, and we will have the two triangles ABD, CBD; whereof AB in one is = to CD in the other, DB common to both, and the angle ABD = CDB (by part 2. theo. 3.); therefore (by theo. 6.) AD = CB, and the angle CBD = ADB, and thence the lines AD and BC are parallel, by the preceding theorem.

Cor. 1. Hence the quadrilateral figure ABCD is a parallelogram, and the diagonal BD bisects the same, inasmuch as the triangle ABD = BDC, as now proved.

Cor. 2. Hence also the triangle ADB on the same base AB, and between the same parallels with the parallelogram ABCD, is half the parallelogram.

Cor. 3. It is hence also plain, that the opposite sides of a parallelogram are equal; for it has been proved that ABCD being a parallelogram, AB will be = CD and AD = BC.

THEO. XIII.

All parallelograms on the same or equal bases and between the same parallels, are equal to one another, that is, if BD = GH, and the lines BH and AF parallel, then the parallelogram ABDC = BDFE = EFHG. fig. 31.

For AC = DB = EF (by cor. the last;) to both add CE, then AE = CF. In the triangles ABE, CDF; AB = CD and AE = CF and the angle BAE = DCF (by part 3. theo. 3.); therefore the triangle ABE = CDF. (by theo. 6.) let the triangle CKE be taken from both, and we will have

Plate I.

have the trapezium ABKC = KDFE; to each of these add the triangle BKD, then the parallelogram ABCD = BDEF; in like manner we may prove the parallelogram EFGH = BDEF. Wherefore ABDC = BDEF = EFHG. Q. E. D.

Cor. Hence it is plain that triangles on the same or equal bases, and between the same parallels, are equal, seeing (by cor. 2. theo. 12.) they are the halves of their respective parallelograms.

THEO. XIV.

In every right-angled triangle, ABC, the square of the hypothenuse or longest side, BC, or BCMH, is equal to the sum of the squares made on the other two sides AB and AC, that is, to ABDE and ACGF. (fig. 32.)

Through A draw AKL perpendicular to the hypothenuse BC, join AH, AM, DC and BG; in the triangles BDC, ABH, BD = BA, being sides of the same square, and also BC = BH, and the included angle DBC = ABH, (for DBA = CBH being both right, to both add ABC, then DBC = ABH) therefore the triangle DBC = ABH (by theo. 6.) but the triangle DBC is half of the square ABDE (by cor. 2. theo. 12.) and the triangle ABH is half the parallelogram BKLH (by the same;) therefore half the square ABDE is equal to half the parallelogram BKLH, and the square ABDE equal to the parallelogram BKLH. The same way it may be proved, that the square ACGF, is equal to the parallelogram KCLM. So ABDE + ACGF the sum of the squares,

Plate I.

ſquares, = BKLH + KCML, the ſum of the two parallelograms or ſquare BCMH; therefore the ſum of the ſquares on AB and AC is equal to the ſquare on BC. Q. E. D.

Cor. 1. Hence the hypothenuſe of a right-angled triangle may be found by having the legs; thus, the ſquare root of the ſum of the ſquares of the baſe and perpendicular, will be the hypothenuſe.

Cor. 2. Having the hypothenuſe and one leg given to find the other; the ſquare root of the difference of the ſquares of the hypothenuſe and given leg, will be the required leg.

THEO. XV.

In all circles the chord of 60 degrees is always equal in length to the radius.

Thus in the circle AEBD, if the arc AEB be an arc of 60 degrees, and the chord AB be drawn; then AB = CB = AC. (fig. 33.)

In the triangle ABC, the angle ACB is 60 degrees, being meaſured by the arc AEB; therefore the ſum of the other two angles is 120 degrees (by cor. 1. theo. 5.) but ſince AC = CB, the angle CAB = CBA (by lemma preceding theo. 7.) conſequently each of them will be 60, the half of 120 degrees, and the three angles will be equal to one another, as well as the three ſides: wherefore AB = BC = AC. Q. E. D.

Cor.

Plate I.

Cor. Hence the radius, from whence the lines on any ſcale are formed, is the chord of 60 degrees on the line of chords.

T H E O. XVI.

If in two triangles ABC, abc, all the angles of one, be each reſpectively equal to all the angles of the other, that is, $A = a$, $B = b$, $C = c$: then the legs oppoſite to the equal angles will be proportional, viz.

$$AB : ab : : AC : ac \qquad \text{Fig. 34.}$$
$$AB : ab : : BC : bc$$
$$\text{and } AC : ac : : BC : bc$$

For the triangles being inſcribed in two circles, it is plain ſince the angle A =a, the arc BDC = b d c, and conſequently the chord BC is to b c, as the radius of the circle ABC is to the radius of the circle a b c; (for the greater the radius is, the greater is the circle deſcribed by that radius; and conſequently the greater any particular arc of that circle is, ſo the chord, ſine, tangent, &c. of that arc will be alſo greater. Therefore, in general, the chord, ſine, tangent, &c. of any arc is proportional to the radius of the circle;) the ſame way the chord AB is to the chord a b, in the ſame proportion. So AB : ab : : BC : bc; the ſame way the reſt may be proved to be proportional.

T H E O. XVII.

If from a point A without a circle DBCE there be drawn two lines ADE, ABC, each of them cutting the circle in two points; the product of one whole

Plate I.

whole line into its external part, viz. AC into AB, will be equal to that of the other line into its external part, viz. AE into AD. fig. 35.

Let the lines DC, BE be drawn in the two triangles ABE, ADC; the angle AEB = ACD, (by cor. 2. theo. 7.) the angle A is common, and (by cor. 1. theo. 5.) the angle ADC = ABE; therefore the triangles ABE, ADC, are mutually equiangular, and confequently, (by the laft) AC : AE : : AD : AB; wherefore AC multiplied by AB, will be equal to AE multiplied by AD. Q. E. D.

THEO. XVIII.

Plate II. fig. 1.

Triangles ABC, BCD, and parallelograms ABCF, and BDEC, having the fame altitude, have the fame proportion between themfelves as their bafes AB and BD.

Let any aliquot part of AB be taken, which will alfo meafure BD: fuppofe that to be Ag, which will be contained twice in AB, and three times in BD, the parts Ag, gB, Bh, hi, and iD being all equal, and let the lines gC, hC, and iC, be drawn: then (by cor. to theo. 13.) all the fmall triangles AgC, gCB, BCh, &c. will be equal to each other; and will be as many as the parts into which their bafes were divided: therefore it will be as the fum of the parts in one bafe, is to the fum of thofe in the other, fo will be the fum of the fmall triangles in the firft, to the fum of the fmall triangles in the fecond triangle; that is, AB : BD : : ABC : BDC.

Whence

Plate II.

Whence alſo the parallelograms ABCF and BDEC, being (by cor. 2. theo. 12.) the doubles of the triangles, are likewiſe as their baſes. Q. E. D.

Note. Wherever there are ſeveral quantities connected with the ſign : : the concluſion is always drawn from the firſt two and laſt two proportionals.

THEO. XIX.

Triangles ABC, DEF, ſtanding upon equal baſes AB and DE, are to each other as their altitudes CG and FH. fig. 2.

Let BI be perpendicular to AB and equal to CG, in which let KB = FH, and let AI and AK be drawn.

The triangle AIB = ACB (by cor. to theo. 13.) and AKB = DEF; but (by theo. 18.) BI : BK : : ABI : ABK. That is, CG : FH : : ABC : DEF. Q. E. D.

THEO XX.

If a right line BE be drawn parallel to one ſide of a triangle ACD, it will cut the two other ſides proportionally, viz. AB : BC : : AE : ED. fig. 3.

Draw CE and BD; the triangles BEC and EBD being on the ſame baſe BE and under the ſame parallel CD, will be equal (by cor. to theo. 13.) therefore (by theo. 18.) AB : BC : : (BEA : BEC or BEA : BED) : : AE : ED. Q. E. D.

Cor.

Plate II.

Cor. 1. Hence alſo AC : AB : : AD : AE : For AC : AB : : (AEC : AEB : : ABD : AEB) : : AD : AE.

Cor. 2. It alſo appears that a right line, which divides two ſides of a triangle proportionally, muſt be parallel to the remaining ſide.

Cor. 3. Hence alſo theo. 16. is manifeſt; ſince the ſides of the triangles ABE, ACD, being equiangular, are proportional.

THEO. XXI.

If two triangles ABC, ADE, have one angle BAC, in one, equal to one angle DAE, in the other, and the ſides about the equal angles, proportional, that is, AB : AD : : AC : AE, then the triangles will be mutually equiangular. Fig. 4.

In AB take Ad = AD, and let de be parallel to BC, meeting AC in e.

Becauſe (by the firſt cor. to the foregoing theo.) AB : Ad : : (AD) AC : Ae, and (by the hypotheſis, or what is given in the theorem) AB : AD : AC : AE; therefore Ae = AE ſeeing AC bears the ſame proportion to each; and (by theo. 6.) the triangle Adc = ADE, therefore the angle Ade = D and Aed = E, but ſince ed and BC are parallel (by part 3. theo. 3.) Ade = B, and Aed = C, therefore B = D and C = E. Q. E. D.

Plate II.

THEO. XXII.

Equiangular triangles ABC, DEF, are to one another in a duplicate proportion of their homologous or like ſides; or as the ſquares AK, and DM of their homologous ſides. Fig. 5.

Let the perpendiculars CG and FH be drawn, as well as the diagonals BI and EL.

The perpendiculars make the triangles ACG and DFH equiangular, and therefore ſimilar (by theo. 16.) for becauſe the angle CAG = FDH and the right angle AGC = DHF, the remaining angle ACG = DFH, (by cor. 2. theo. 5.)

Therefore GC : FH : : (AC : DF : :) AB : DE, or which is the ſame thing, GC : AB : : FH : DE, for FH multiplied by AB = AB multiplied by FH.

By theo. 19. ABC : ABI : : (CG : AI or AB as before : : FH DE or DL : :) DFE : DLE, therefore ABC : ABI : : DFE : DLE or ABC : AK : : DFE : DM, for AK is double the triangle ABI, and DM double the triangle DEF, by cor. 2. theo. 12. Q. E. D.

THEO. XXIII.

Like polygons ABCDE, a b c d e, are in a duplicate proportion to that of the ſides AB, a b, which are between the equal angles A and B, and a and b, or as the ſquares of the ſides AB, ab. fig. 6.

Draw AD, AC, ad, ac.

By

Plate II.

By the hypotheſis AB : ab : : BC : bc, and thereby alſo the angle B = b ; therefore (by theo. 21.) BAC = b a c ; and ACB = a c b ; in like manner EAD = e a d, and EDA = e d a. If therefore from the equal angles A, and a, we take the equal ones EAD + BAC = e a d + b a c the remaining angle DAC = d a c, and if from the equal angles D and d, EDA = e d a be taken, we ſhall have ADC = a d c : and in like manner if from C and c be taken BCA = b c a we ſhall have ACD = a c d ; and ſo the reſpective angles in every triangle, will be equal to thoſe in the other.

By theo. 22. ABC : a b c : : the ſquare of AC to the ſquare of ac, and alſo ADC : adc : : the ſquare of ~~AC, to the~~ ſquare of a c ; therefore from equality of proportions ABC : a b c : : ADC : a d c, in like manner we may ſhew ~~that ADC~~ : a d c : EAD : e a d : Therefore it will be as one antecedent is to one conſequent, ſo are all the antecedents to all the conſequents. That is, ABC : a b c as the ſum of the three triangles in the firſt polygon, is to the ſum of thoſe in the laſt. Or ABC will be to a b c, as polygon to polygon.

The proportion of ABC to a b c (by the foregoing theo.) is as the ſquare of AB is to the ſquare of a b, but the proportion of polygon to polygon, is as ABC to a b c, as now ſhewn : therefore the proportion of polygon to polygon is as the ſquare of AB to the ſquare of ab.

THEO.

Plate II.

THEO. XXIV.

Let DHB be a quadrant of a circle deſcribed by the radius CB ; HB an arc of it, and DH its complement ; HL or FC the ſine, FH or CL its co-ſine ; BK its tangent, DI its co-tangent ; CK its ſecant, and CI its co-ſecant. Fig. 8.

1. The co-ſine of an arc is to the ſine, as radius is to the tangent.

2. Radius is to the tangent of an arc, as the co-ſine of it is to the ſine.

3. The ſine of an arc is to its co-ſine, as radius to its co-tangent.

4. Or radius is to the co-tangent of an arc, as its ſine to its co-ſine.

5. The co-tangent of an arc is to radius, as radius to the tangent.

6. The co-ſine of an arc is to radius, as radius is to the ſecant.

7. The ſine of an arc is to radius, as the tangent is to the ſecant.

The triangles CLH and CBK, being ſimilar, (by theo. 16.)

1. CL : LH : : CB : BK.

2. Or, CB : BK : : CL : LH.

The

Plate II.

The triangles CFH and CDI, being ſimilar.

3. CF (or LH) : FH : : CD : DI.

4. CD : DI : : CF (or LH) : FH.

The triangles CDI and CBK are ſimilar; for the angle CIB = KCB, being alternate ones (by part 2. theo. 3.) the lines CB and DI being parallel: the angle CDI = CBK being both right, and conſequently the angle DCI = CKB, wherefore,

5. DI : CD : : CB : BK.

And again, making uſe of the ſimilar triangles CLH and CBK,

6. CL : CB : : CH : CK.

7. HL : CH : BK : CK.

GEOMETRICAL PROBLEMS.

PROBLEM I.

Plate II.

TO *make a triangle of three given right lines BO, LB, LO, of which any two muſt be greater than the third. Fig.* 7.

Lay BL from B to L; from B with the line BO, deſcribe an arc, and from L with LO deſcribe another arc; from O, the interſection point of thoſe arcs, draw BO and OL, and BOL is the triangle required.

This is manifeſt from the conſtruction.

PROB. II.

At a point B in a given right line BC, to make an angle equal to a given angle A. fig. 8.

Draw any right line ED to form a triangle, as EAD, take BF = AD, and upon BF make the triangle BFG, whoſe ſide BG = AE, and GF = ED (by the laſt) then alſo the angle B = A; if we ſuppoſe one triangle be laid on the other, the ſides will mutually agree with each other, and therefore be equal; for if we conſider theſe two triangles are made of the ſame given three lines, they are manifeſtly one and the ſame triangle.

Otherwiſe,

Upon

Plate II.

Upon the centers A and B, at any diſtance, let two arcs, DE, FG, be deſcribed; make the arc FG = DE, and thro' B and G draw the line BG, and it is done.

For ſince the chords ED, GF, are equal, the angles A and B are alſo equal, as before (by def. 19.)

PROB. III.

To biſect or divide into two equal parts, any given right-lined angle, BAC. fig. 9.

In the lines AB and AC, from the point A ſet off equal diſtances AE = AD, then, with any diſtance more than the half of DE, deſcribe two arcs to cut each other in ſome point F; and the right-line AF, joining the points A and F, will biſect the given angle BAC.

For if DF and FE be drawn, the triangles ADF, AEF, are equilateral to each other, *viz.* AD = AE, DF = FE, and AF common, wherefore DAF = EAF, as before.

PROB. IV.

To biſect a right line, AB. fig. 10.

With any diſtance, more than half the line, from A and B, deſcribe two circles CFD, CGD, cutting each other in the points C and D; draw CD, interſecting AB in E, then AE = EB.

For,

Plate II.

For, if AC, AD, BC, BD, be drawn; the triangles ACD, BCD, will be mutually equilateral, and consequently the angle ACE = BCE: therefore the triangle ACE, BCE, having AC = BC, CE common, and the angle ACE = BCE; (by theo. 6.) the base AE = the base BE.

Cor. Hence it is manifest, that CD not only bisects AB, but is perpendicular to it. (By def. 11.)

PROB. V.

On a given point A, in a right line EF, to erect a perpendicular. Fig. 11.

From the point A lay off on each side, the equal distances, AC, AD; and from C and D, as centers, with any interval greater than AC or AD, describe two arcs intersecting each other in B; from A to B draw the line AB, and it will be the perpendicular required.

For, let CB, and BD be drawn; then the triangles CAB, DAB, will be mutually equilateral and equiangular, so CAB = DAB, a right angle, (by def. 11.)

PROB. VI.

To raise a perpendicular on the end B of a right line AB. fig. 12.

From any point D not in the line AB, with the distance from D to B, let a circle be described cutting AB in E; draw from E thro' D the right line EDC, cutting the periphery in C, and join CB; and that is the perpendicular required.

Plate II.

EBC being a ſemicircle, the angle EBC will be a right angle (by cor. 5. theo. 7.)

PROB. VII.

From a given point A, to let fall a perpendicular upon a given right line BC. fig. 13.

From any point D, in the given line, take the diſtance to the given point A, and with it deſcribe a circle AGE, make GE = AG, join the points A and E, by the line AFE, and AF will be the perpendicular required.

Let DA, DE, be drawn; the angles ADF = FDE, DA = DE, being radii of the ſame circle, and DF common; therefore (by theo. 6.) the angle DFA = DFE, and FA a perpendicular. (By def. 11.)

PROB. VIII.

Thro' a given point A, to draw a right line AB, parallel to a given right line CD. fig. 14.

From the point A, to any point, F, in the line CD, draw the line AF; with the interval FA, and one foot in F, deſcribe the arc AE, and with the like interval and one foot in A, deſcribe the arc BF, making BF = AE; thro' A and B draw the line AB, and it will be parallel to CD.

By prob. 2. The angle BAF = AFE, and by theo. 11. BA and CD are parallel.

Plate II.

PROB. IX.

Upon a given line AB to describe a square ABCD. plate I. *fig.* 17.

Make BC perpendicular and equal to AB; and from A and C, with the line AB, or BC, let two arcs be described, cutting each other in D; from whence to A and C, let the lines AD, DC be drawn; so is ABCD the square required.

For all the sides are equal by construction; therefore the triangles ADC and BAC, are mutually equilateral and equiangular, and ABCD is an equilateral parallelogram, whose angles are right. For B being right, D is also right, and DAC, DCA, BAC, ACB, each half a right angle (by lemma preceding theo. 7. and cor. 2. theo. 5.) whence DAB and BCD will each be a right angle, and (by def. 44.) ABCD is a square.

SCHOLIUM.

By the same method a rectangle or oblong, may be described, the sides thereof being given.

PROB. X.

To divide a given right line AB, into any proposed number of equal parts. Fig. 15.

Draw the infinite right line AP, making any angle with AB, also draw BQ parallel to AP, in each of which, let there be taken as many equal parts

Plate II.

parts AM, MN, &c. Bo, on, &c. as you would have AB divided into; then draw Mm, Nn, &c. interſecting AB in E, F, &c. and it is done.

For MN and mn, being equal and parallel, FN will be parallel to EN; and in the ſame manner, GO to FN (by theo. 12.) therefore AM, MN, NO, being all equal by conſtruction, it is plain (from theo. 20.) that AE, EF, FG, &c. will likewiſe be equal.

PROB. XI.

To find a third proportional to two given right lines, A and B. fig. 16.

Draw two infinite blank lines CE, CD, anywiſe to make an angle. Lay the line A, from C to F; and the line B, from C to G; and draw the line FG; lay again the line A, from C to H; and thro' H, draw HI parallel to FG (by prob. 8.) ſo is CI the third proportional required.

For, by cor. 1. theo. 20. CG : CH : : CF : CI.

Or, B : A : : A : CI.

PROB. XII.

Three right lines A, B, C, given to find a fourth proportional. (Fig. 17.*)*

Having

Plate II.

Having made an angle DEF anywife, by two infinite blank right lines, ED, EF; as before; lay the line A, from E to G; the line B, from E to I; and draw the line IG; lay the line C, from E to H, and (by prob. 8.) draw HK parallel thereto, fo will EK be the fourth proportional required.

For, by cor. 1. theo. 20. EG : EI : : EH : EK,

Or, A : B : : C : EK.

PROB. XIII.

Plate III.

Two right lines, A and B, given to find a mean proportional. (*Fig.* 1.)

Draw an infinite blank line, as AF, on which lay the line A, from A to B, and the line B, from B to C, on the point B, which is the joining of the lines A and B; erect a perpendicular BD (by prob. 5.) bifect AC in E (by prob. 4.) and defcribe the femicircle ADC; and from the point D, where its periphery cuts the perpendicular BD, draw the line BD, and that will be the mean proportional required.

For if the lines AD, DC, be drawn, the angle ADC is a right angle (by cor. 5. theo. 7.) being an angle in a femicircle.

The angles ABD, DBC, are right ones (by def. 11.) the line BD being a perpendicular; wherefore the triangles ABD, DBC, are fimilar, thus the angle ABD = DBC, being both right, the angle DAC is the complement of BDA to a right angle (by cor. 2. theo. 5.) and is therefore equal to BDC, the angle ADC being a right angle as before; confequently

Plate III.

ſequently (by cor. 1. theo. 5.) the angle ADB = DCB, wherefore (by theo. 16.)

AB : BD : : BD : BC.
Or, A : BD : : BD : B.

PROB. XIV.

To divide a right line AB, in the point E, ſo that AE ſhall have the ſame proportion to EB, as two given lines C and D have. (Fig. 2)

Draw an infinite blank line, AF, to the extremity of the line AB, to make with it any angle: lay the line C, from A to C; and D, from C to D; and join the points B and D, by the line BD; thro' C, draw CE parallel to BD (by prob. 8.) ſo is E the point of diviſion.

For, by cor. 1. theo. 20. AC : AD : : AE : AB.
Or, C : D : : AE : EB.

PROB. XV.

To deſcribe a circle about a triangle ABC or (which is the ſame thing) thro' any three points, A, B, C, which are not ſituate in a right line. (Fig. 3.)

By prob. 4. Biſect the line AC by the perpendicular DE, and alſo CB, by the perpendicular FG, the point of interſection H, of theſe perpendiculars, is the center of the circle required, from which take the diſtance to any of the three points A, B, C, and deſcribe the circle ABC, and it is done.

For

Plate III.

For, by cor. to theo. 8. The lines DE and FG, muſt each paſs thro' the center, therefore, their point of interſection, H, muſt be the center.

SCHOLIUM.

By this method the center of a circle may be found, by having only a ſegment of it given.

PROB. XVI.

To make an angle of any number of degrees, at the point A, of the line AB, ſuppoſe of 45 degrees. (Fig. 4.)

From a ſcale of chords take 60 degrees, for 60 is equal to the radius (by cor. theo. 15.) and with that diſtance from A, as a center, deſcribe a circle from the line AB; take 45 degrees, the quantity of the given angle, from the ſame ſcale of chords, and lay it on that circle from a to b, thro' A and b, draw the line AbC; and the angle A, will be an angle of 45 degrees, as required.

If the given angle were more than 90, take its half (or divide it into any two parts leſs than 90) and lay them after each other on the arc which is deſcribed with the chord of 60 degrees; thro' the extremity of which, and the center, let a line be drawn, and that will form the angle required, with the given line.

Plate III.

PROB. XVII.

To meaſure a given angle ABC. (fig. 5.)

If the lines which include the angle, be not as long as the chord of 60 on your ſcale, produce them to that or a greater length, and between them ſo produced, with the chord of 60 from B, deſcribe the arc e d; which diſtance e d, meaſured on the ſame line of chords, gives the quantity of the angle BAC 48 degrees, as required; this is plain from def. 19.

PROB. XVIII.

To make a triangle BCE equal to a given quadrilateral figure ABCD. fig. 6.

Draw the diagonal AC, and parallel to it (by prob. 8.) DE, meeting AB produced in E; then draw CE, and ECB will be the triangle required.

For the triangles ADC, AEC, being upon the ſame baſe AC, and under the ſame parallel ED (by cor. to theo. 13.) will be equal, therefore if ABC be added to each, then ABCD = BEC.

PROB. XIX.

To make a triangle DFH, equal to a given five-ſided figure ABCDE. fig. 7.

Draw DA and DB, and alſo EH and CF, parallel to them (by prob. 8.) meeting AB produced in H and

Plate III.

H and F; then draw DH, DF, and the triangle HDF is the one required.

For the triangle DEA DHA, and DBC = DFB (by cor. to theo. 13.) therefore by adding theſe equations, DEA + DBC = DHA + DFB, if to each of theſe ADB be added; then DEA + ADB + DBC = ABCDE = (DHA + ABD + DFB) = DHF.

PROB. XX.

To project the lines of chords, ſines, tangents, and ſecants, to any radius. *Fig.* 8.

On the line AB, let a ſemicircle ADB be deſcribed; let CD be drawn perpendicular to the center C, and the tangent BE perpendicular to the end of the diameter; let the quadrants, AD, DB, be each divided into 9 equal parts, every of which will be 10 degrees; if then from the center C, lines be drawn thro' 10, 20, 30, 40, *&c.* the diviſions of the quadrant BD, and continued to BF, we ſhall there have the tangents of 10, 20, 30, 40, *&c.* and the ſecants C 10, C 20, C 30, *&c.* are transferred to the line CD, produced by deſcribing the arcs 10, 10: 20, 20: 30, 30, *&c.* If from 10, 20, 30, *&c.* the diviſions of the quadrant BD, there be let fall perpendiculars, let theſe be transferred to the radius CD, and we ſhall have the ſines of 10, 20, 30, *&c.* and if from A we deſcribe the arcs 10, 10: 20, 20: 30, 30, *&c.* from every diviſion of the arc AD; we ſhall have a line of chords. The ſame way we may have the ſine, tangent, *&c.* to every ſingle degree on the

the quadrant, by ſubdividing every of the 9 former diviſions into 10 equal parts. By this method the ſines, tangents, &c. may be drawn to any radius; and if after, they be transferred to lines on a rule, we ſhall have the ſcales of ſines, tangents, &c. ready for uſe.

Concerning Scales of equal Parts.

If an inch be divided into any aſſigned number of equal parts, and if theſe parts be continued on in a right line, and if the laſt of them be ſubdivided into 10 equal parts, and thence if the firſt diviſions be numbered with 1, 2, 3, 4, &c. as far as the ruler upon which they are transferred will admit, the ſcale is completed.

Theſe numbers, 1, 2, 3, 4, &c. uſually ſtand for 10, 20, 30, 40, &c. and every one of the ſubdiviſions is called 1: but if the numbers 1, 2, 3, 4, &c. be called 100, 200, 300, 400, &c. then every one of the ſubdiviſions will be 10, and the units muſt be gueſſed at.

On one ſide of moſt ſurveying ſcales, there are lines or ſcales, marked at the end with 50, 45, 40, 35, 30, 25, 15, 10. and ſometimes with other numbers; theſe are ſcales of ſo many parts to an inch (whether of feet, yards, perches, or miles) as the reſpective number at the end of each expreſſes; but in the ſurveying way, they are counted to be ſo many perches to an inch, and ſometimes ſo many feet to an inch.

On the contrary ſide there are two ſcales, one of 10, and the other of 20; or one of 100, and the

 other

other of 200; or one of 1000, and the other of 2000 parts to an inch, diagonally divided; (a view of the fcale will make all eafy:) the firft of thefe furveyors call a fcale of 10, and the other a fcale of 20 perches to an inch; and are thus counted: every large divifion is 10, every one of the fubdivifions is 1, and every one downwards is one tenth of a perch; or fometimes thus, every large divifion is called 100, every fubdivifion 10, and every one downwards 1: or again, frequently by navigators, every large divifion is called 1000, every fubdivifion 100, every one downwards 10, and the tenth part of the diftance between the lines 1.

Hence it is eafy to meafure the length of any line, knowing the fcale by which it was laid down; and on the contrary, to fet off any given diftance from any fcale.

OF LOGARITHMS.

IF to a ſeries of numbers in geometrical progreſſion, whoſe common ratio is 10, and firſt term 1; we annex another ſeries of numbers in arithmetical progreſſion, whoſe firſt term is 0, and common difference 1: theſe latter numbers will be the logarithms of the former.

Numbers.	Logarithms.
1	0.00000
10	1.00000
100	2.00000
1000	3.00000
10000	4.00000, &c.

If ſeveral geometrical means be taken, and the like number of arithmetical ones, to the correſponding numbers, the latter will be the logarithms of the former.

The nature therefore of logarithms is ſuch, that addition of them anſwers to the multiplication of their correſponding numbers; and ſubtraction to diviſion: that is, when two numbers propoſed are to be multiplied into each other, if we take the logarithms anſwering to thoſe numbers, and add them together, the ſum will be the logarithm anſwering to the number, which is the product of the two propoſed numbers.

Again,

Again, when one number is propoſed to be divided by another; if from the logarithm of the dividend, we ſubtract the logarithm of the diviſor, the remainder ſhall be the logarithm of the quotient.

Moſt tables of logarithms contain the logarithms of all numbers from 1 to 10000, the column marked at the top N, is that in which you muſt find your number; in the ſame line with which, in the adjacent column, is the logarithm of that number.

EXAMPLE.

Required, the logarithm of 365.

Anſwer, 2.56229.

And though moſt tables of logarithms run but to 10000, yet by them the log. of any number not exceeding 10,000,000 may be found and on the contrary, the number to any ſuch logarithm, thus,

1. Find the log. of the firſt four figures of the given number.

2. Take that log. from the log. of the number next following, and note their difference.

3. Multiply that difference by the remaining figures of the given number; and from the product, cut off as many figures as remain in the given number, or as the given number is more than four (counting from the right to the left) as in decimals.

4. The

4. The whole number in the product, added to the first log. is the log. required; but the first figure, which is called the index, or characteristic, must be changed; and always be one less than the number of figures in the logarithm.

EXAMPLE I.

Required, the logarithm of the number 3567894

The log. of 3567, which are the first four figures, is - - - 3.55230

The log. of the following or next number, *viz.* 3568, is - - - 3.55242

Their difference, - - -	12
Mult. by the remaining fig. *viz.* - -	.894

Cut off 3 figures, because 894 is 3 figures, and the product is - - 10.728

To which add the first log. -	3.55230
Their sum is - -	3.55240

But because the given number consists of 7 figures, the index must be one less, which is 6; so the above index, 3, must be changed to 6, and we have 6.55240 the log. of 3567894 required.

EXAMPLE II.

Required, the log. of the number 125607.

The log. of 1256 is - -	3.09899
The next log. following is -	3.09934

Their

Their difference is - -	35
Multiply by .07 the remaining figures .	.07
Product. - - -	2.45
To which add the first log. -	3.09899
Their sum is - -	3.09901

Because the given number consists of 6 places, change the last index to 5, which is one less than the places in the given number; and you have 5.09901, the log. of 125607 required.

Because any number consisting of both integers and decimals, is equal to the quotient of the whole considered as an integer, divided by the denominator of the decimal part; and since by the nature of logarithms, subtraction in them answers the quotient of other numbers; therefore it follows, that when a number is given, consisting of integers and decimals, we can find its log. thus: find the log. of the whole considered as one integer; then from that, take the log. of the denominator of the decimal part; or (which is the same thing) from the index of the log. of the whole considered as an integer, subtract a number less by one, than the number of places in the denominator of the fraction, and the remainder will be the log. required; or the index of the log. must be 1 less, than the number of figures in the integer to which the decimal is annexed.

Example I.

What is the log. of the number 36.5?

Find the log. of 365, which is 2.56229: then because 10 is the denominator of the decimal part of the proposed number, and 1.00000 its log. therefore, from 2.56229, take 1.00000, and there remains 1.56229 the log. required.

Or,

Or, becauſe the whole number conſiſts of two figures, the index of the log. muſt be one leſs, and is therefore 1.56229, as before.

EXAMPLE II.

What are the logs. of 6543, 654.3, 65.43, 6.543, .6543, .06543 and .006543?

6543	3.81578
654.3	2.81578
65.43	1.81578
6.543	0.81578
.6543	$\overline{9}$.81578
.06543	$\overline{8}$.81578
.006543	$\overline{7}$.81578

For the log. of a decimal fraction is the ſame as that of an integer; only the index is negative, and is ſo much leſs than 0. as the place of the decimal is removed from unity; and thoſe indices may be diſtinguiſhed from abſolute ones, by ſetting a negative ſign over them, as above.

To find the Number of a given Logarithm.

Look for the given log. amongſt the logs. from 1000 to 10000 (not regarding the index or firſt figure) and if you find the exact log. you want, you have in the margin the required number. But if the index of the given log. be leſs than 3, cut off from the number found, as many figures as it is leſs; and the figures ſo cut off will be decimals, and the others integers. Or if the firſt figure or index, be greater than 3, add as many cyphers to the number found, as it is more, and you have the number required.

EXAM-

EXAMPLES.

Find the numbers correſpondent to the following logarithms.

Given logarithms.			Numbers.
5·55230	Anſwer		356700.
4·55230	—	—	35670.
3·55230	—		3567.
2·55230	—	—	356.7
1·55230	—		35·67
0·55230	—	—	3·567
9·55230	—	—	·3567
8·55230	—	—	·03567
7·55230	—	—	·003567, &c.

But if the exact log. cannot be found in the table, and the number of figures required exceed four, then

1. Find as before (not regarding the index) the log. anſwering to the firſt four figures, but leſs than the given log.

2. Take that from the given one, and if the remainder do not conſiſt of two figures, prefix a cypher to it; and after theſe two figures annex three cyphers, ſo will you have five figures for a dividend.

3. Divide that by the difference between the log. found, and the next following, and if your quotient do not conſiſt of three figures, prefix a cypher or cyphers to make it; which three figures place after the firſt four found.

Then obſerve the index of the given log. which ſhews how many figures muſt be integers, and how many decimals; for the number of integers

tegers is one more than the given index as before.

EXAMPLE I.

1. Required, the number of the log. 4.55241

The neareſt log. which is leſs is its number is 3567.	3.55230
The difference of theſe with three cyphers is for a dividend - - -	11000
The log. found - -	3.55230
The next log. - - -	3.55242
Their difference will give for a diviſor	12

```
12)11000(916 Quotient.
   108
   ---
     20
     12
     --
      80
     ---
```

Which quotient place after the firſt four figures found, and you have 3567916; and becauſe the index is 4, the number will be 35679.16 required.

2. Required, the number anſwering to the log. 5.09901.

The neareſt log. to which is 3.09899, its No. 1256

Dividend 02000

Log. found 3.09899
Next log. 3.09934

35 Divifor 35)02000(57
175

250
245

5

Becaufe the quotient confifts of but two figures, prefix a cypher to it to make it three, and it is 057; which annexed to the firft four found, is 1256057; and becaufe the index of the given log. is 5, its number will be 125605.7.

From what has been faid on this head, the following problems may eafily be folved by logarithms, *viz.*

PROB. I.

Multiply 134 by 25.6

To log. of 134	- -	2.12810
Add the log. of 25.6	- -	1.40824
	Sum	3.53534

The number anfwering to which fum, *viz.* 3430, is nearly the product of 134 by 25.6 and is the anfwer.

Again, multiply 234 by 36.

To

To log. of 234	2.36922	
Add the log. of 36	1.55630	
Sum	3.92552	its number

is 8424 required.

PROB. II.

What is the quotient of 828 by 23?

From the log. of 828	2.91803	
Take the log. of 23	1.36173	
Difference	1.55630	its number

is 36 the quotient required.

Again, what is the quotient of 30550 by 47?

From the log. of 30550	4.48501	
Take the log. of 47	1.67210	
	2.81291	its number

is 650 the quotient required.

PROB. III.

Three numbers in a direct proportion given, to find a fourth.

From the ſum of the logarithms of the ſecond and third numbers; deduct the logarithm of the firſt, the remainder will be the logarithm of the fourth required.

EXAM-

Example I.

Let the three propofed numbers be 36, 48, 66, to find a fourth proportional.

To log. of 48	1.68124
Add log. of 66	1.81954
Sum	3.50078
Take log. of 36	1.55630
	1.94448 the number is 88 the

fourth required.

Again, let three numbers be 240, 1440, 1230, to find a fourth proportional.

To the log. of 1440	3.15836
Add the log. of 1230	3.08991
From the product	6.24827
Take the log. of 240	2.38021
	3.86806 its number 7380

the 4th required.

PROB. IV.

To find the fquare of any given number.

Multiply the given number's logarithm by 2, and the product is the logarithm of its fquare.

Exam-

EXAMPLE.

Required, the ſquare of 36.

Log. of 36	1.55630
Multiply by	2
	3.11260 its number 1296 the

ſquare required.

PROB. V.

To extract the ſquare root of any given number.

Take half of the logarithm of the number, and that is the logarithm of its ſquare root.

EXAMPLE.

Required, the ſquare root of 1296.

Log. of 1296	3.11261
Its half is	1.55630 its number is 36 the

ſquare root of the number required.

By the manner of projecting the lines of chords, ſines, tangents, and ſecants (being prob. 20 of geometry) it is evident, that if the radius be ſuppoſed any number of equal parts (as 1000 or 10000, &c.) the ſine, tangent, &c. of every arc, muſt conſiſt of ſome number of thoſe equal parts; and by computing them in parts of the radius,

dius, we have tables of ſines, tangents, &c. to every arc of the quadrant, called natural ſines, tangents, &c. and the logarithms of theſe give us tables of logarithmic ſines, tangents, &c. and ſuch are uſually bound up with logarithms of numbers.

In which you may obſerve, that each page is divided into 8 columns, the firſt and laſt of which are minutes, and the intermediate ones contain the ſines, tangents, and ſecants, the upper and lower columns contain degrees, the column of the minutes on the left hand of each page, anſwers to the degrees in the top column; and the ſines, tangents, and ſecants belonging to thoſe degrees and minutes, are in the columns marked at the top with the words ſine, tangent, and ſecant; the column of minutes on the right hand of each page, anſwers to the degrees in the bottom of the page; and the ſines, tangents, and ſecants, anſwering to thoſe degrees and minutes, are in the columns, marked at the bottom with the words ſine, tangent, ſecant; the degrees in the top column beginning at 0, proceed to 44, where they end; and thoſe at the bottom of the page begin at 89, and proceed to 45 in a decreaſing ſeries; the degrees in the different columns being the complement of each other. From what has been ſaid, we may eaſily find the ſine, tangent, or ſecant of any arc, from the tables, by looking for the given number of degrees at the head or foot of the page, according as they are leſs or greater than 45, and in the proper ſide column for the odd minutes, if there be any; then below or above the word ſine, tangent, or ſecant, and on the ſame line with the minutes, we ſhall have that which was required.

EXAM-

EXAMPLE I.

Required, the fine of 36 degrees 40 minutes.

Look at the head of the page for 36 degrees, and in the fide column on the left hand, for 40 minutes; then below the word fine, on the fame line with 40, we find 9.77609; which is that required.

EXAMPLE II.

Required, the tangent of 54 degrees 30 minutes.

Look at the foot of the page (becaufe the propofed degrees are more than 45.) for 54 degrees, and in the right hand column for 30 minutes; then in the column marked tangent at its bottom, and on the fame line with the 30 minutes, in the fide column, we find 10.14673, which is the log-tangent required.

The reverfe of this, *viz.* The logarithm of a fine, tangent, or fecant, being given, to find the arc belonging to it, is performed by only looking in the proper column, for the neareft logarithm to that propofed, and the degrees and minutes anfwering thereto, are thofe required.

We will now fhew how any fine, tangent, or fecant may be had, tho' the figures in the tables were defaced, mif-printed, or obliterated.

PROB. I.

To find the tangent which is defaced, by the fine and co-fine.

The

The co-ſine taken from the ſine added to 90, or radius, which is 10.00000, the remainder is the tangent. (By part 1. theo. 24.)

Example.

1. Suppoſe the tangent of 41°. 20′, was defaced, but the ſine and co-ſine of it viſible.

From the ſine of 41°. 20′ + 10.00000, or radius, - - -	19.81983
Take the co-ſine of 41°. 20′	9.87557
The rem. is the tan. of 41°. 20′ req. *viz.*	9.94426

2. To find a ſine which is miſ-printed, by help of the co-ſine and tangent.

From the ſum of the tangent and co-ſine, take 10.00000, or radius, or (which is the ſame thing) cut off the firſt figure in the index, the remainder is the ſine required (by part 2. theo. 24.)

Example.

Suppoſe the ſine of 46°. 50′ was defaced, but the tangent and co-ſine viſible.

To the tangent of 46°. 50′	10.02781
Add the co-ſine of 46°. 50′	9.83513
Their ſum is the ſine of 46°. 50′ req. *viz.*	9.86294

The co-tangent and co-ſine of any arc, may be had by the ſame method; the complement of any degree, being only its reſidue from 90, or a quadrant,

quadrant, as before obſerved, (by theo. 24. part 3 and 4.).

3. To find a tangent by the help of a co-tangent only.

From twice the radius, which is 20.00000, take the co-tangent, the remainder is the tangent, (by theo. 24. part 5.)

EXAMPLE.

Required, the tangent of 29°. 50′ being defaced, as alſo the ſine and co-ſine defaced, by the co-tangent only.

From twice the radius,	20.00000
Take the co-tangent of 29°. 50′	10.24148
The rem. is the tang. of 29°. 50′ req.	9.75852

4. To find the ſecant by the help of a co-ſine; which may be found of great uſe when a table of ſines and tangents can only be had.

From twice the radius, which is 20.00000, take the co-ſine, and the remainder will be the ſecant, (by theo. 24. part 6.)

EXAMPLE.

Required, the ſecant of 57°. 20′ by the help of the co-ſine only.

From the double radius,	20.00000
Take the co-ſine of 57°. 20′	9.73219
The rem. is the ſecant of 57°. 20′ req.	10.26781

5. To find a ſecant by the help of the ſine and tangent.

From the tangent added to radius, take the ſine, the remainder will be the ſecant, (by theo. 24. part 7.)

EXAMPLE.

Required, the ſecant of 57°. 20′ by help of the ſine and tangent.

From the tan. of 57°. 20′ + 10.00000 the radius,	20.19303
Take the ſine of 57°. 20′	9.92522
The rem. is the ſecant of 57°. 20′ req.	10.26781

The ſecants in theſe tables might have been omitted, becauſe all proportions in which they are concerned, may be wrought by ſines and tangents only, as ſhall be ſhewn in the ſeveral caſes of plane trigonometry; and are here only inſerted that all the various methods of reſolving triangles may be ſhewn.

SECT.

SECT. II.

Containing Plane Trigonometry, right-angled and oblique; with its Application in determining the Meafures of inacceffible Heights and Diftances.

Plane Trigonometry

IS the fcience of meafuring the fides and angles of plane triangles. It is divided into two parts, *viz.* into rectangular and oblique angular trigonometry, becaufe every triangle is either right-angled or oblique; therefore we fhall begin with

RECTANGULAR TRIGONOMETRY.

Plate V. fig. 1.

1. In every right angled plane triangle ABC, if the hypothenufe AC be made the radius, and with it a circle, or an arc of one, be defcribed from each end; it is plain (from def. 22.) that BC is the fine of the angle A, and AB is the fine of the angle C; that is, the legs are the fines of their oppofite angles.

2. If

Plate V.

2. If one leg AB be made the radius, and with it, on the point A, an arc be deſcribed; then BC is the tangent, and AC is the ſecant of the angle A, by def. 24 and 25. Fig. 2.

3. If BC be made the radius, and an arc be deſcribed with it on the point C; then is AB the tangent, and AC is the ſecant of the angle C, as before. Fig. 3.

Becauſe the ſine, tangent, or ſecant of any given arc in one circle, is to the ſine, tangent, or ſecant of a like arc (or to one of the like number of degrees) in another circle; as the radius of the one is to the radius of the other; therefore the ſine, tangent, or ſecant of any arc is proportional to the ſine, tangent, or ſecant of a like arc, as the radius of the given arc is to 10.00000, the radius from whence the logarithmic ſines, tangents, and ſecants, in moſt tables, are calculated, i. e.

If AC be made the radius, the ſines of the angle A and C, deſcribed by the radius AC, will be proportional to the ſines of the like arcs, or angles in the circle, that the tables now mentioned were calculated for. So if BC was required, having the angles and AB given, it will be fig. 1.

As S.C : AB : : S.A : BC.

i. e. As the ſine of the angle C in the tables, is to the length of AB; (or ſine of the angle C, in a circle whoſe radius is AC;) ſo is the ſine of the

Plate V.

the angle A in the tables, to the length of BC, (or ſine of the ſame angle, in the circle, whoſe radius is AC.)

In like manner, the tangents and ſecants repreſented by making either leg the radius, will be proportional to the tangents and ſecants of a like arc, as the radius of the given arc is to 10.00000, the radius of the tables aforeſaid.

Hence it is plain, that if the name of each ſide of the triangle be placed thereon, a proportion will ariſe to anſwer the ſame end as before: thus if AC be made the radius, let the word radius be written thereon; and as BC and AB, are the ſines of their oppoſite angles; upon the firſt let S.A, or ſine of the angle A, and on the other let S.C, or ſine of the angle C, be wrote: then, When a ſide is required, it may be obtained by this proportion, *viz.*

As the name of the ſide given
  is to the ſide given,
So is the name of the ſide required
  to the ſide required.

Thus, if the angles A and C, and the hypothenuſe AC were given, to find the legs; the proportions will be

1. R : AC : : S.A : BC. fig. 1.
That is, as radius is to AC, ſo is the ſine of the angle A, to BC. And,
2. R : AC : : S.C : AB.
That is, as radius is to AC, ſo is the ſine of the angle C, to AB.

When

Plate V.

When an angle is required, we uſe this proportion, *viz.*

As the ſide that is made the radius,
is to radius,
So is the other given ſide,
to its name.

Thus, if the legs were given to find the angle A, and if AB be made the radius, it will be

AB : R : : BC : T.A. fig. 2.

That is, as AB, is to radius, ſo is BC, to the tangent of the angle A.

After the ſame manner, the ſides or angles of all right angled plane triangles may be found, from their proper data.

We here, in plate 4, give all the proportions requiſite for the ſolution of the ſix caſes in rectangular trigonometry; making every ſide poſſible the radius.

In the following triangles, this mark — in an angle, denotes it to be known, or the quantity of degrees it contains to be given; and this mark ′ on a ſide, denotes its length to be given in feet, yards, perches, or miles, *&c.* and this mark °, either in an angle or on a ſide, denotes the angle or ſide required.

From

Plate V.

From theſe proportions it may be obſerved; that, to find a ſide, when the angles and one ſide are given, any ſide may be made the radius: and to find an angle, one of the given ſides muſt be made the radius. So that in the 1ſt, 2d, and 3d caſes, any ſide, as well required as given, may be made the radius, and in the firſt ſtatings of the 4th, 5th, and 6th caſes, a given ſide only is made the radius.

RECTANGULAR TRIGONOMETRY.

CASE I.

THE *angles and hypothenuſe given, to find the baſe and perpendicular.* *Fig.* 4.

In the right angled triangle ABC, ſuppoſe the angle A 46°. 30′. and conſequently the angle C 43°. 30′. (by cor. 2. theo. 5.); and AC 250 parts, (as feet, yards, miles, &c.) required the legs AB and BC.

Geometrically.

Make an angle of 46°. 30′, in blank lines, (by prob. 16. ſect. 1.) as CAB; lay 250, which is the given hypothenuſe, from a ſcale of equal parts, from A to C; from C, let fall the perpendicular BC, (by prob. 7. ſect. 1.) and that will conſtitute the triangle ABC. Meaſure the lines BC, and AB, from the ſame ſcale of equal parts that AC was taken from; and you have the anſwer.

By

Plate V.

By Calculation.

1. *Making AC the radius*, the required ſides are found by theſe propoſitions, as in plate 4. caſe 1.

R : AC : : S.A : BC.
R : AC : : S.C : AB.

i. e.	As radius,	90°	10.00000
	is to AC,	250	2.39794
	So is the ſine of A	46°. 30′	9.86056
	to BC,	181. 4	2.25850

As radius,	90°	10.00000
is to AC,	250	2.39794
So is the ſine of C	43°. 30′	9.83781
to AB,	172. 1.	2.23575

If from the ſum of the ſecond and third logs. that of the firſt be taken, the remainder will be the log. of the fourth; the number anſwering to which, will be the thing required; but when the firſt log. is radius, or 10.00000, reject the firſt figure of the ſum of the other two logs. (which is the ſame thing as to ſubtract 10.00000;) and that will be the log. of the thing required.

2. *Making AB the radius.*

Secant A : AC : : R : AB.
Secant A : AC : : T.A : BC.

i. e.

i. e. As the ſecant of A	46°. 30′	10.16219
is to AC,	250	2.39794
So is radius	90°	10.00000
		12.39794
to AB,	172. 1	2.23575

As the ſecant of A	46°. 30′	10.16219
is to AC,	250	2.39794
So is the tangent of A	46°. 30′	10.02275
		12.42069
to BC.	181. 4	2.25850

3. *Making BC the radius.*

Sec. C : AC : : R : BC.

Sec. C : AC : : T. C : AB.

i. e. As the ſecant of C	43°. 30′	10.13944
is to AC,	250	2.39794
So is radius	90°	10.00000
		12.39794
to BC,	181. 4	2.25850

As the ſecant of C	43°. 30′	10.13944
is to AC,	250	2.39794
So is the tangent of C	43°. 30′	9.97725
		12.37519
to AB,	172. 1	2.23575

Or, having found one leg, the other may be obtained by cor. 2. theo. 14. ſect. 1.

By Gunter's Scale.

On this ſcale there are lines of numbers, ſines, and

and tangents, as well as lines of ſine and tangent rumbs, verſed ſines, meridional parts, and equal parts: but the three firſt lines are ſufficient for our preſent purpoſe.

The diviſions on theſe reſpective lines, are the logarithms of numbers, ſines, and tangents, taken from a ſcale of equal parts, and applied on the lines of the ſcale.

The firſt and third terms in the foregoing proportions, being of a like nature, and thoſe of the ſecond and fourth being alſo like to each other; and the proportions being direct ones, it follows; that if the third term be greater or leſs than the firſt, the fourth term will be alſo greater or leſs than the ſecond: therefore the extent in your compaſſes, from the firſt to the third term, will reach from the ſecond to the fourth.

Thus, to extend the firſt of the foregoing proportions;

1. Extend from 90° to 46°. 30′, on the line of ſines; that diſtance will reach from 250 on the line of numbers, to 181, for BC.

2. Extend from 90° to 43°. 30′, on the line of ſines; that diſtance will reach from 250 on the line of numbers, to 172, for AB.

If the firſt extent be from a greater, to a leſs number; when you apply one point of the compaſſes to the ſecond term, the other muſt be turned to a leſs; and the contrary.

By def. 22. ſect. 1. The ſine of 90° is equal to the radius; and the tangent of 45° is alſo equal to the radius; becauſe if one angle of a right angled

angled triangle be 45°, the other will be alſo 45°; and thence (by the lemma preceding theo. 7. ſect. 1.) the tangent of 45° is equal to the radius: for this reaſon the line of numbers of 10.00000, the ſine of 90°, and tangent of 45° being all equal, terminate at the ſame end of the ſcale; where there are ſmall braſs centers, uſually placed to preſerve the ſcale.

It was ſaid before, that the tangents ended at 45°; but becauſe the logarithms of tangents more than 45°, muſt paſs off the ſcale; ſuch diſtances therefore, as exceed 45°, are ſet backwards from 45, and numbered 50, 60, 70, &c.

There is no line of ſecants on the ſcale; for every thing requiſite can be performed without them.

Thus the two firſt ſtatings of this caſe, anſwer the queſtion without a ſecant: the like will be alſo made evident in all the following caſes.

C A S E 2.

The baſe and angle given; to find the perpendicular and hypothenuſe.

Plate V. fig. 5.

In the triangle ABC there is the angle A 42°. 20′, and of courſe the angle C 47°. 40 (by cor. 2. theo. 5.) and the leg AB 190, given; to find BC and AC.

Geometrically.

Make the angle CAB (by prob. 16. ſect. 1.) in blank lines, as before. From a ſcale of equal parts, lay 190 from A to B; on the point B, erect a perpendicular BC (by prob. 5. ſect. 1.) the point where

where this cuts the other blank line of the angle, will be C; ſo is the triangle ABC conſtructed: let AC and BC be meaſured from the ſame ſcale of equal parts that AB was taken from, and you have the anſwer.

By Calculation.

1. *Making AC the radius.*

S. C : AB : : R : AC.
S. C : AB : : S. A : BC.

i. e. As the ſine of C	47°. 40′	9.86879
is to AB,	190	2.27875
So is radius	90°	10.00000
		12.27875
to AC,	257	2.40996

As the ſine of C	47°. 40′	9.86879
is to AB,	190	2.27875
So is the ſine of A	42°. 20′	9.82830
		12.10705
to BC,	173. 1	2.23826

2. *Making AB the radius.*

R : AB : : T. A : BC.
R : AB : : Sec. A : AC.

i. e. As radius	90°	10.00000
is to AB,	190	2.27875
So is the tangent of A	42°. 20′	9.95952
to BC,	173. 1	2.23827

As

As radius	90°	10.00000
is to AB,	190	2.27875
So is the secant of A	42°. 20′	10.13121
to AC,	257	2.40996

3. *Making BC the radius.*

T. C : AB : : Sec. C : AC.
T. C : AB : : R : BC.

i. e. As the tangent of C	47°. 40′	10.04048
is to AB,	190	2.27875
So is the secant of C	47°. 40′	10.17170
		12.45045
to AC,	257	2.40997

As the tangent of C	47°. 40′	10.04048
is to AB,	190	2.27875
So is radius	90°	10.00000
		12.27875
to BC,	173. 1	2.23827

Or, having found one of the required sides, the other may be obtained, by one or the other of the cors. to theo. 14. sect. 1.

By Gunter's Scale.

1. When AC is made the radius.

Extend from 47°. 40′, to 90° on the line of sines;

ſines; that diſtance will reach from 190 to 257, on the line of numbers, for AC.

2. When AB is made the radius, the firſt ſtating is thus performed.

Extend from 45° on the tangents (for the tangent of 45° is equal to the radius, or to the ſine of 90°, as before) to 42°. 20′; that extent will reach from 190, on the line of numbers, to 173, for BC.

3. When BC is made the radius, the ſecond ſtating is thus performed.

Extend from 47°. 40′, on the line of tangents, to 45°, or radius; that extent will reach from 190 to 173, on the line of numbers, for BC; for the tangent of 47°. 40′, is more than the radius; therefore the fourth number muſt be leſs than the ſecond, as before.

The two firſt ſtatings of this caſe, anſwer the queſtion without a ſecant.

C A S E 3.

The angles and perpendicular given; to find the baſe and hypothenuſe.

Plate V. fig. 6.

In the triangle ABC, there is the angle A 40°, and conſequently the angle C 50°, with BC 170, given; to find AC and AB.

Geo-

Geometrically.

Make an angle CAB of 40° in blank lines; (by prob. 16. ſect. 1.) with BC 170, from a line of equal parts, draw the popped lines EF parallel to AB (by prob. 8. ſect. 1.) the lower line of the angle, and from the point where it cuts the other line in C, let fall a perpendicular BC (by prob. 7. ſect. 1.) and the triangle is conſtructed: the meaſures of AC and AB, from the ſame ſcale that BC was taken, will anſwer the queſtion.

What has been ſaid in the two foregoing caſes, is ſufficient to render the operations in this, both by calculation and Gunter's ſcale, ſo obvious, that it is needleſs to inſert them; however, for the ſake of the learner, we give for

Anſwer, AC 264. 5, and AB 202. 6.

C A S E 4.

The baſe and hypothenuſe given; to find the angles and perpendicular.

Plate V. fig. 7.

In the triangle ABC, there is given, AB 300 and AC 500: the angles A and C, and the perpendicular BC, are required.

Geometrically.

From a ſcale of equal parts, lay 300 from A to B; on B erect an infinite blank perpendicular line, with AC 500, from the ſame ſcale, and one foot of the compaſs, in A, croſs the perpendicular line in C; and the triangle is conſtructed.

By

By prob. 17. fect. 1. Meafure the angle A, and let BC be meafured from the fame fcale of equal parts that AC and AB were taken from; and you have the anfwer.

By Calculation.

1. *Making AC the radius.*

AC : R : : AB : S.C.
R : AC : : S.A : BC.

i. e. As AC	500	2.69897
is to radius,	90°	10.00000
So is AB	300	2.47712
		12.47712
to the fine of C,	36°. 52′	9.77815

By cor. 2. theo. 5. 90°—36°. 52′ = 53°. 08′ the angle A.

As radius	90°	10.00000
is to AC,	500	2.69897
So is the fine of A	53°. 08′	9.90301
to BC,	400	2.60198

2. *Making AB the radius.*

AB : R : : AC : fec. A.
R : AB : : T. A : BC.

i. e.

i. e. As AB	300	2.47712
is to radius,	90°	10.00000
So is AC	500	2.69897
		12.69897
to the fecant of A, 53°. 08′		10.22185

As radius	90°	10.00000
is to AB,	300	2.47712
So is the tangent of A	53°. 08′	10.12499
to BC,	400	2.60211

Or BC may be found from cor. 2. theo. 14. fect. 1.

By Gunter's Scale.

1. Making AC the radius.

Extend from 500 to 300, on the line of numbers; that extent will reach from 90°, on the line of fines, to 36°. 52′ for the angle C.

Again, Extend from 90° to 53°. 08′, on the line of fines, that extent will reach from 500 to 400, on the line of numbers, for BC.

2. Making AC the radius, the fecond ftating is thus performed.

Extend from radius, or the tangent of 45°, to 53°. 08′, that extent will reach from 300 to 400, for BC.

CASE 5.

The perpendicular and hypothenuſe given, to find the angles and baſe.

Plate V. fig. 8.

In the triangle ABC there is BC 306, and AC 370, given; to find the angles A and C, and the baſe AB.

Geometrically.

Draw a blank line from any point, in which, at B, erect a perpendicular, on which lay BC 306, from a ſcale of equal parts: from the ſame ſcale, with AC 370, in the compaſſes, croſs the firſt drawn blank line in A, and you have the triangle ABC conſtructed.

Meaſure the angle A (by prob. 17. ſect. 1.); and alſo B, from the ſame ſcale of equal parts the other ſides were taken from, and you have the anſwer.

The operations by calculation, the ſquare root, and Gunter's ſcale, are here omitted, as they have been heretofore fully explained: the ſtatings, or proportions muſt alſo be obvious, from what has already been ſaid.

Anſwer. The angle A 55°. 48′; therefore the angle C 34°. 12′, and AB 208.

CASE 6.

The base and perpendicular given; to find the angles and hypothenuse.

Plate V. fig. 9.

In the triangle ABC, there is AB 225, and BC 272, given; to find the angles A and C, and the hypothenuse AC.

Geometrically.

Draw a blank line, on which lay AB 225, from a scale of equal parts; at B, erect a perpendicular; on which lay BC, 272, from the same scale; join A and C, and the triangle is constructed.

As before, let the angle A, and the hypothenuse AC be measured; and you have the answer.

By Calculation.

1. *Making AB the radius.*

AB : R : : BC : T. A.
R : AB : : Sec. A : AC.

2. *Making BC the radius.*

BC : R : : AB : T. C.
R. : BC : : Sec. C : AC.

By calculation; the answer from the foregoing proportions is easily obtained, as before.

But

But becauſe AC, by either of the ſaid proportions, is found by means of a ſecant; and ſince there is no line of ſecants on Gunter's ſcale; after having found the angles, as before, let us ſuppoſe AC the radius, and then

1. S. A : BC : : R. : AC.
or, 2. S. C : AB : : R. : AC.

Theſe proportions may be eaſily reſolved, either by calculation or Gunter's ſcale, as before; and thus the hypothenuſe AC may be found without a ſecant.

From the two given legs, the hypothenuſe may be eaſily obtained, from cor. 1. theo. 14. ſect. 1.

Thus the ſquare of AB = 50625
Add the ſquare of BC = 73984

```
        124609(353 = AC
        9
     65)346
        325
    703)2109
        2109
```

From what has been ſaid on logarithms, it is plain,

1. That half the logarithm of the ſum of the ſquares of the two ſides, will be the logarithm of the hypothenuſe. Thus,

The ſum of ſquares, as before, is 124609; its log. is 5.09554, the half of which is 2.54777; and

and the correſponding number to this, in the tables, will be 353, for AC.

2. And that half of the logarithm of the difference of the ſquares of AC and AB, or of AC and BC, will be the logarithm of BC, or of AB.

The following examples are inſerted for the uſe of the learner.

$$1.\ \text{Given,}\left\}\begin{array}{lr}\text{the angle } C & 64^\circ.\ 40'\\ \quad AC & \underline{3876}\end{array}\right\{\begin{array}{l}AB\\ BC\end{array}\ \text{required.}$$

$$2.\ \text{Given,}\left\}\begin{array}{lr}\text{the angle } C & 47^\circ.\ 20'\\ \quad AB & \underline{17}\end{array}\right\{\begin{array}{l}AC\\ BC\end{array}\ \text{required.}$$

$$3.\ \text{Given,}\left\}\begin{array}{lr}\text{the angle } C & 28^\circ.\ 30'\\ \quad BC & \underline{27187}\end{array}\right\{\begin{array}{l}AB\\ AC\end{array}\ \text{required.}$$

$$4.\ \text{Given,}\left\}\begin{array}{lr}AB & 2\\ AC & \underline{3}\end{array}\right\{\begin{array}{l}\text{the angles}\\ \text{and } BC\end{array}\ \text{required.}$$

$$5.\ \text{Given,}\left\}\begin{array}{lr}BC & 17\\ AC & \underline{21.6}\end{array}\right\{\begin{array}{l}\text{the angles}\\ \text{and } AB\end{array}\ \text{required.}$$

$$6.\ \text{Given,}\left\}\begin{array}{lr}AB & 2871.64\\ BC & \underline{3176.2}\end{array}\right\{\begin{array}{l}\text{the angles}\\ \text{and } AC\end{array}\ \text{required.}$$

The anſwers are omitted, that the learner may reſolve them himſelf by the foregoing methods; by which means he will find and ſee more diſtinctly their mutual agreements; and become more expert, and the better acquainted with the ſubject.

OBLIQUE

OBLIQUE ANGULAR PLANE TRIGONOMETRY.

BEFORE we proceed to the ſolution of the four caſes of Oblique angular triangles, it is neceſſary to premiſe the following theorems.

THEO. I.

Plate V.

In any plane triangle ABC, the ſides are proportional to the ſines of their oppoſite angles, i. e. *S. C : AB : : S. A : BC, and S. C : AB : : S. B : AC ; alſo S. B : AC : : S. A : BC. fig.* 10.

By theo. 10. ſect. 1. the half of each ſide is the ſine of its oppoſite angle; but the ſines of thoſe angles, in tabular parts, are proportional to the ſines of the ſame in any other meaſure; and therefore, the ſines of the angles will be as the halves of their oppoſite ſides: and ſince the halves are as the wholes, it follows, that the ſines of their angles are as their oppoſite ſides, i. e. S. C : AB : : S. A : BC, *&c.* Q. E. D.

THEO. II.

In any plane triangle ABC, the ſum of the two given ſides AB and BC, including a given angle ABC, is to their difference, as the tangent of half the ſum of the two unknown angles A and C is to the tangent of half their difference. Fig. 11.

Produce

Plate V.

Produce AB and make HB = BC, and join HC: let fall the perpendicular BE, and that will biſect the angle HBC (by theo. 9. ſect. 1.) through B draw BD parallel to AC, and make HF = DC, and join BF; take BI = BA, and draw IG parallel to BD or AC.

It is then plain, that AH will be the ſum, and HI the difference of the ſides AB and BC: and ſince HB = BC, and BE perpendicular to HC, therefore HE = EC (by theo. 8. ſect. 1.); and ſince BA = BI, and BD and IG parallel to AC, therefore GD = DC = FH, and conſequently HG = FD, and $\frac{1}{2}$ HG = $\frac{1}{2}$ FD or ED. Again, EBC being half HBC, will be alſo half the ſum of the angles A and C (by theo. 4. ſect. 1.) Alſo, ſince HB, HF, and the included angle H, are ſeverally equal to BC, CD, and the included angle BCD; therefore (by theo. 6. ſect. 1.) HBF = DBC = BCA (by part 2. theo. 3. ſect. 1.) and ſince HBD = A (by part 3. theo. 3. ſect. 1.) and HBF = BCA; therefore BFD is the difference, and EBD, half the difference of the angles A and C: then making BE the radius, it is plain, that EC will be the tangent of half the ſum, and ED the tangent of half the difference of the two unknown angles A and C: now IG being parallel to AC; AH : IH : : CH : GH. (by cor. 1. theo. 20. ſect. 1.) But the wholes are as their halves, i. e. AH : IH : : CE : ED, that is, as the ſum of the two ſides AB and BC, is to their difference; ſo is the tangent of half the ſum of the two unknown angles A and C, to the tangent of half their difference. Q. E. D.

THEO.

Plate V.

THEO. III.

In any right lined plane triangle ABD; the baſe AD, will be to the ſum of the other ſides, AB, BD, as the difference of thoſe ſides, is to the difference of the ſegments of the baſe, made by the perpendicular BE; viz. *the difference between AE and ED. fig.* 12.

Produce BD, till BG = AB the leſſer leg; and on B as a center, with the diſtance BG or BA, deſcribe a circle AGHF; which will cut BD, and AD in the points H and F: then it is plain, that GD will be the ſum, and HD the difference of the ſides AB and BD; alſo ſince AE = EF (by theo. 8. ſect. 1.) therefore, FD is the difference of AE and ED, the ſegments of the baſe: but (by theo. 17. ſect. 1.) AD : GD : : HD : FD; that is, the baſe is to the ſum of the other ſides, as the difference of thoſe ſides, is to the difference of the ſegments of the baſe. Q. E. D.

THEO. IV.

If to half the ſum of two quantities, be added half their difference; the ſum will be the greateſt of them: and if from half the ſum be ſubtracted half their difference; the remainder will be the leaſt of them. Fig. 13.

Let the two quantities be repreſented by AB and BC; (making one continued line;) whereof AB is the greateſt, and BC the leaſt; biſect the whole line AC in E; and make AD = BC; then it

Plate V.

it is plain, that AC is the ſum, and DB the difference of the two quantities; and AE or EC, their half ſum, and DE or EB, their half difference. Now if to AE we add EB, we ſhall have AB, the greateſt quantity; and if from EC we take EB, we ſhall have BC the leaſt quantity. Q. E. D.

Cor. Hence, if from the greateſt of two quantities, we take half the difference of them, the remainder will be half their ſum; or if to half their difference be added the leaſt quantity, their ſum will be half the ſum of the two quantities.

OBLIQUE ANGULAR TRIGONOMETRY.

TWO *ſides, and an angle oppoſite to one of them given; to find the other angles and ſide.*

In the triangle ABC, there is given AB 240, *the angle A* 46°. 30′, *and BC* 200; *to find the angle C, being acute, the angle B, and the ſide AC. fig.* 14.

Geometrically.

Draw a blank line, on which ſet AB 240, from a ſcale of equal parts; at the point A, of the line AB, make an angle of 46°. 30′, by an infinite blank line; with BC 200, from a like ſcale of equal parts that AB was taken, and one foot in B, deſcribe the arc DC to cut the laſt blank line in the points D and C. Now if the angle C had been required obtuſe, lines from D to B, and

 to

Plate V.

to A, would conſtitute the triangle; but as it is required acute, draw the lines from C to B, and to A, and the triangle ABC is conſtructed. From a line of chords let the angles B and C be meaſured; and AC from the ſame ſcale of equal parts that AB and BC were taken; and you will have the anſwer required.

By Calculation.

This is performed by theo. 1. of this ſect. thus;

As BC	200	2.30103
is to the ſine of A	46°. 30′	9.86056
So is AB	240	2.38021
		12.24077
to the ſine of C,	60°. 31′	9.93974

180—the ſum of the angles A and C, will give the angle B; by cor. 1. theo. 5. ſect. 1.

A 46°. 30′
C 60. 31

180—107.01 = 72°. 59′ = B.

As the ſine of A	46°. 30′	9.86056
is to BC,	200	2.30103
So is the ſine of B	72°. 59′	9.98056
		12.28159
to AC,	263. 7	2.42103

By

Plate V.

By Gunter's Scale.

Extend from 200 to 240, on the line of numbers; that diſtance will reach from 46°. 30′ on the line of ſines, to 60°. 31′ for the angle C.

Extend from 46°. 30′, to 72°. 59′, on the line of ſines; that diſtance will reach from 200 to 263.7, on the line of numbers, for AC.

CASE 2.

Two angles and a ſide given; to find the other ſides.

In the triangle ABC, there is the angle A 46°. 30′, *AB* 230, *and the angle B* 37°. 30′, *given, to find AC and BC. fig.* 15.

Geometrically.

Draw a blank line, upon which ſet AB 230, from a ſcale of equal parts; at the point A of the line AB, make an angle of 46°. 30′, by a blank line; and at the point B of the line AB, make an angle of 37°. 30′, by another blank line; the interſection of thoſe lines gives the point C, ſo is your triangle ABC conſtructed. Meaſure AC and BC from the ſame ſcale of equal parts that AB was taken; and you have the anſwer required.

By Calculation.

By (cor. 1. theo. 5. ſect. 1.) 180—the ſum of the angles A and B = C.

A 46°.

Plate V.

A	46°.	30′
B	37.	30

180°—84. 00 = 96°. 00′ = C.

By def. 29. sect. 1. The sine of 96° = the sine of 84°, which is the supplement thereof; therefore instead of the sine of 96°, look in the tables for the sine of 84°.

By theo. 1. of this sect.

As the sine of C	96°. 00′	9.99761
is to AB,	230	2.36173
So is the sine of A	46°. 30′	9.86056
		12.22229
to BC,	167.8	2.22468

As the sine of C	96°. 00′	9.99761
is to AB,	230	2.36173
So is the sine of B	37°. 30′	9.78445
		12.14618
to AC,	140.8	2.14857

By Gunter's Scale.

Extend from 84° (which is the supplement of 96°) to 46°. 30′ on the sines; that distance will reach from 230 to 168, on the line of numbers, for BC.

Extend

Plate V.

Extend from 84° to 37°. 30′, on the ſines; that extent will reach from 230 to 141, on the line of numbers, for AC.

CASE 3.

Two ſides and a contained angle given; to find the other angles and ſide.

In the triangle ABC, there is AB 240, *the angle A* 36° 40′ *and AC* 180, *given; to find the angles C and B, and the ſide BC. fig.* 16.

Geometrically.

Draw a blank line, on which from a ſcale of equal parts, lay AB 240; at the point A of the line AB, make an angle of 36°. 40′, by a blank line; on which from A, lay AC 180, from the ſame ſcale of equal parts; meaſure the angles C and B, and the ſide BC, as before; and you have the anſwer required.

By Calculation.

By cor. 1. theo. 5. ſect. 1. 180—the angle A 36°. 40′ = 143°. 20′ the ſum of the angles C and B: therefore half of 143°. 20′, will be half the ſum of the two required angles, C and B.

By theo. 2. of this ſect.

As the ſum of the two ſides AB and AC	420
is to their difference,	60

So

Plate V.

So is the tangent of half the ſum of the two unknown angles C and B	71°. 40′
to the tangent of half their difference	23°. 20′

By theo. 4.

To half the ſum of the angles C and B	71°. 40′
Add half their difference as now found	23. 20
The ſum is the greateſt angle, or ang. C	95. 00
Subtract, and you have the leaſt angle, or B	48. 20

The angles C and B, being found; BC is had, as before, by theo. 1. of this ſect. Thus,

S. B : AC : : S : A : BC.
48°. 20′ 180 36°. 40′ 143. 9.

By Gunter's Scale.

Becauſe the two firſt terms are of the ſame kind extend from 420 to 60 on the line of numbers; lay that extent from 45° on the line of tangents, and keeping the left leg of your compaſſes fixed, move the right leg to 71°. 40′; that diſtance laid from 45° on the ſame line, will reach to 23°. 30′, the half difference of the required angles. Whence the angles are obtained, as before.

The ſecond proportion may be eaſily extended, from what has been already ſaid.

CASE

Plate V.

C A S E 4.

The ſides given, to find the angles.

In the triangle ABC, there is given, AB 64, *AC* 47, *BC* 34: *the angles A, B, C, are required. Fig.* 17.

Geometrically.

The conſtruction hereof muſt be manifeſt, from prob. 1. ſect. 1.

By Calculation.

From the point C, let fall the perpendicular CD on the baſe AB; it will divide the triangle into two right angled ones, ADC and CBD; as well as the baſe AB, into the two ſegments, AD and DB.

AC	47
BC	34
Sum	81
Difference	13

By theo. 3. of this ſect.

As the baſe or the longeſt ſide, AB	64
is to the ſum of the other ſides, AC and BC,	81
So is the difference of thoſe ſides	13
to the difference of the ſegments of the baſe AD, DB.	16.46

By

Plate V.

By theo. 4. of this sect.

To half the base, or to half the sum of the segments AD and DB	32
Add half their difference, now found,	8.23
Their sum will be the greatest segment AD	40.23
Subtract, and their difference will be the least segment DB, - -	23.77

In the right angled triangle ADC, there is AC 47, and AD 40. 23, given, to find the angle A.

This is resolved by case 4. of right angled plane trigonometry, thus,

AD : R : : AC : Sec. A.
40. 23 : 90°. : : 47 : 31°. 08′

Or it may be had by finding the angle ACD, the complement of the angle A; without a secant, thus,

AC : R : : AD : S. ACD.
47 : 90° : : 40. 23 : 58°. 52′

90—58°. 52′ = 31°. 08′, the angle A.

Then, by theo. 1. of this sect.

BC : S. A : : AC : S. B.
34 : 31°. 08′ : : 47 : 45°. 37′.

By

By cor. 1. theo. 5. ſect. 1. 180—the ſum of A and B = C.

A	31°. 08′
B	45. 37
	180—76. 45 = 103°. 15′, the angle C.

By Gunter's Scale.

The firſt proportion is extended on the line of numbers; and it is no matter whether you extend from the firſt to the third, or to the ſecond term, ſince they are all of the ſame kind: If you extend to the ſecond, that diſtance applied to the third, will give the fourth; but if you extend from the firſt to the third, that extent will reach from the ſecond to the fourth.

The methods of extending the other proportions have been already fully treated of.

An example in each caſe of oblique angular trigonometry.

1. Given, { AC 290, C 69°. 30′, AB 350 } A, B, BC required.

2. Given, { C 24°. 20′, B 128. 30, AC 3246 } AB, BC required.

3. Given, { AC 6, C 124°. 30′, BC 4. 5 } A, B, AB required.

 4. Given

Plate V.

4. Given, $\left\{\begin{array}{ll} AB & 46 \\ AC & 92 \\ BC & 52 \end{array}\right\}$ $\begin{array}{l} A \\ B \\ C \end{array}$ required.

Having thus gone through plane trigonometry, we ſhall now proceed to apply the ſame, in determining the meaſures of inacceſſible heights and diſtances. And firſt,

O F

OF HEIGHTS.

Plate V.

THE instrument of leaſt expence for taking heights, is a quadrant, divided into 90 equal parts or degrees; and thoſe may be ſubdivided into halves, quarters, or eighths, according to the radius, or ſize of the inſtrument: its conſtruction will be evident by the ſcheme thereof. (Fig. 18.)

From the center of the quadrant let a plummet be ſuſpended by a horſe hair, or a fine ſilk thread, of ſuch a length that it may vibrate freely, near the edge of its arc: by looking along its edge AC, to the top of the object whoſe height is required; and holding it perpendicular, ſo that the plummet may neither ſwing from it, nor lie on it; the degree then cut by the hair, or thread, will be the angle of altitude required.

If the quadrant be fixed upon a ball and ſocket, on a three-legged ſtaff, and if the ſtem from the ball be turned into the notch of the ſocket, ſo as to bring the inſtrument into a perpendicular poſition, the angle of altitude by this means, can be acquired with much greater certainty.

An

Plate V.

An angle of altitude may be alſo taken by any of the inſtruments uſed in ſurveying; as ſhall be particularly ſhewn, when we treat of their deſcriptions and uſes.

Moſt quadrants have a pair of ſights fixed on the edge AC, with ſmall circular holes in them; which are uſeful in taking the ſun's altitude, requiſite to be known in many aſtronomical caſes; this is effected by letting the ſun's ray, which paſſes thro' the upper ſight, fall upon the hole in the lower one; and the degree then cut by the thread, will be the angle of the ſun's altitude; but thoſe ſights are uſeleſs for our preſent purpoſe, for looking along the quadrant's edge to the top of the object will be ſufficient, as before.

PROB. I.

Plate V. fig. 19.

To find the height of a perpendicular object at one ſtation, which is on an horizontal plane.

A ſteeple.

Given,
- The angle of altitude, 53 degrees.
- Diſtance from the obſerver to the foot of the ſteeple, or the baſe, 85 feet.
- Height of the inſtrument, or of the obſerver, 5 feet.

Required, the height of the ſteeple.

The figure is conſtructed and wrought, in all reſpects, as caſe 2. of right angled trigonometry; only there muſt be a line drawn parallel to, and beneath

Plate V. fig. 19.

beneath AB of 5 feet for the obferver's height, to reprefent the plane upon which the object ftands; to which the perpendicular muft be continued, and that will be the height of the object.

Thus, AB is the bafe, A the angle of altitude, BC the height of the fteeple from the inftrument, or from the obferver's eye, if he were at the foot of it; DC the height of the fteeple above the horizontal furface.

Various ftatings for BC, as in cafe 2. of right angled plane trigonometry.

$$\begin{array}{l} 90^\circ \\ 53 = A \\ \hline 37 = C \\ \hline \end{array}$$

1. S. C : AB : : S. A : BC.
   37° 85 53° 112. 8.

2. R. : AB : : T. A : BC.
   90° 85 53° 112. 8.

3. T. C : AB : : R. : BC.
   37° 85 90° 112. 8.

To BC	112. 8	
Add DB	5.	the height of the obferver.

Their fum is 117. 8 or 118 feet, the height of the fteeple required.

PROB.

PROB. II.

Plate V. fig. 20.

To find the height of a perpendicular object, on an horizontal plane; by having the length of the ſhadow given.

Provide a rod, or ſtaff, whoſe length is given, let that be ſet perpendicular, by the help of a quadrant, thus; apply the ſide of the quadrant AC, to the rod, or ſtaff; and when the thread cuts 90°. it is then perpendicular; the ſame may be done by a carpenter's, or maſon's plumb.

Having thus ſet the rod or ſtaff perpendicular; meaſure the length of its ſhadow, when the ſun ſhines, as well as the length of the ſhadow of the object, whoſe height is required; and you have the proper requiſites given. Thus,

ab, the length of the ſhadow of the ſtaff, 15 feet.

bc, the length of the ſtaff, 10 feet.

AB, the length of the ſhadow of the ſteeple, or object, 135 feet.

Required BC, the height of the object.

The triangles *abc*, ABC, are ſimilar, thus: the angle $b = B$, being both right; the lines *ac*, AC are parallel, being rays, or a ray of the ſun; whence the angle $a = A$ (by part 3. theo. 3. ſect. 1.) and conſequently $c = C$. The triangles being therefore

therefore mutually equiangular, are ſimilar (by theo. 16. ſect. 1.) it will be,

ab : *bc* : : AB : BC.
15 10 135 90. the ſteeple's height, required.

The foregoing method is moſt to be depended on; however, this is mentioned for variety's ſake.

PROB. III.

To take the altitude of a perpendicular object, at the foot of a hill, from the hill's ſide.

Turn the center A of the quadrant, next your eye, and look along the ſide AC, or 90 ſide, to the top and bottom of the object; and noting down the angles, meaſure the diſtance from the place of obſervation to the foot of the object. Thus,

Given, { Angle to the foot of the object, $55^{\circ}\frac{1}{4}$ or $55^{\circ}.\ 15'$
Angle to the top of it, $31^{\circ}\frac{1}{4}$ or $31^{\circ}.\ 15'$.
Diſtance to the foot of it, 250 feet.

Required, the height of the object.

Geometrically.

Draw an infinite blank line AD, at any point in which A, make the angle EAB of $55^{\circ}.\ 15'$, and EAC of $31^{\circ}.\ 15'$; lay 250 from A to B; from B, draw the perpendicular BE (by prob. 7. of geometry) croſſing AC in C; ſo will BC be the height of the object required.

In

Plate V. fig. 21.

In the triangle ABC, there is given,

ABE the complement of EAB to 90°, which is 34°. 45′.

ACB the difference of the given angles 24°. 00′.

The side AB, 250. Required, BC.

This is performed as case 2. of oblique angular trigonometry. Thus,

180—the sum of ABE 34°. 45′, and CAB 24°. 00′ = ACB 121°. 15′. Then,

S. ACB : AB : : S. CAB : BC.
121°. 15′ 250 24°. 00′ 119, the height required.

PROB. IV.

To take the altitude of a perpendicular object, on the top of a hill, at one station; when the top and bottom of it can be seen from the foot of the hill.

Plate V. fig. 22.

As in prob. 1. take an angle to the top, and another to the bottom of the object; and measure from the place of observation to the foot of the object, and you have all the given requisites. Thus,

A tower on a hill.

Given, { Angle to the bottom, 48°. 30′.
Angle to the top, 67°. 00′.
Dist. to the foot of the object, 136 feet.

Required, the height of the object.

Geo-

Plate V. fig. 22.

Geometrically.

Make the angle DAB = 48°. 30′, and lay 136 feet from A to B; from B, let fall the perpendicular BD; and that will be the height of the hill: produce BD upwards by a blank line: again, at A make the angle DAC = 67°. 00′ by a blank line, and from C where that croſſes the perpendicular produced, draw the line CB, and that will be the height of the object required.

Let AC be drawn.

In the triangle ABC, there is given,

The angle ACD the complement of DAC = 23°. 00′.

CAB the difference between the two given angles = 18°. 30′.

And the ſide AB 136. To find BC.

S. C :	AB : :	S. CAB :	BC.
23°	136	18°. 30′	$110\frac{1}{2}$.

If BD were wanted, it is eaſily obtained, by the firſt caſe of right angled plane trigonometry.

PROB. V.

To take an inacceſſible perpendicular altitude, on an horizontal plane.

Plate V. fig. 23.

This is done at two ſtations, thus;

Plate V. fig. 23.

Let DC be a tower which cannot be approached, by means of a moat or ditch, nearer than B; at B, take an angle of altitude to C: meaſure any convenient diſtance backward to A, which note down: at A, take another angle to C; ſo have you the given requiſites, thus;

Given, $\begin{cases} \text{Firſt angle, } 55^{\circ}.\ 00'. \\ \text{Stationary diſtance, 87 feet.} \\ \text{Second angle, } 37^{\circ}.\ 00'. \end{cases}$

The height of the tower CD, is required.

Geometrically.

Upon an infinite blank line, lay off the ſtationary diſtance 87, from A to B; from B, ſet off your firſt; and from A, your ſecond angle: from C, the point of interſection of the lines which form theſe angles, let fall the perpendicular CD; and that will be the height of the object required.

The external angle CBD, of the triangle ABC; is equal to the two internal oppoſite ones, A, and ACB (by theo. 4. ſect. 1.): wherefore if one of the internal oppoſite angles be taken from the external angle; the remainder will be the other internal oppoſite one, thus;

$$CBD\ 55^{\circ} - A\ 37^{\circ} = ACB\ 18^{\circ}.$$

Therefore in the triangle ABC; we have the angles A, and ACB, with the ſide AB given; to find BC.

S. ACB

Plate V. fig. 23.

S. ACB : AB : : S. A : BC.
18° 87 37° 169.4

Having found BC, we have in the triangle BCD; the angle CBD 55°, confequently BCD 35°, and BC 169.4; to find DC.

This is performed by cafe the firft, of right angled trigonometry, three feveral ways; thus;

1. R : BC : : S. CBD : DC.
90° 169.4 55° 138.8.
The height required.

2. Sec. CBD : BC : : T. CBD : DC.
55° 169.4 55° 138.8.
The height required.

3. Sec. BCD : BC : : R : CD.
35° 169.4 90° 138.8.
The height required.

If BD, the breadth of the moat, were required; it may alfo be found, by three different ftatings, as in the firft cafe of right angled plane trigonometry.

PROB. VI.

Plate V. fig. 24.

Let BC, a may-pole, whofe height is 100 feet, be broken at D; the upper part of which, DC, falls upon an horizontal plane, fo that its extremity, C, is 34 feet from the bottom or foot of the pole.

Required, the fegments BD and DC.

Geo-

Geometrically.

Lay 34 feet from A to B; on B, erect the perpendicular BC of 100 feet; and draw AC: bisect AC (by prob. 4. sect. 1.) with the perpendicular line, EF; and from D, where it cuts the perpendicular BC, draw AD, which will be the upper segment; and DB will be the lower.

By cor. to lemma, preceding theo. 7. sect. 1. AD = DC; and (by the lemma) the angle C = CAD.

In the triangle ABC, find C, as in case 6, of right angled trigonometry, thus;

1. BC :	R : :	AB :	T. C = GAD.		
100	90°	34	18°. 47′		

By theo. 4. sect. 1. The external angle ABD = 37°. 34′, or to twice the angle C, i. e. to C and GAD.

Then in the triangle ABD, there is ADB 37°. 34′ therefore also its complement DAB 52°. 26,′ and AB 34, given, to find AD and BD.

By the second case of rectangular trigonometry.

2. S. ADB :	AB : :	R :	AD or DC.
37° 34′	34	90°	55·77·

BC—DC = BD.
100— 55·77 = 44·23 required.

These

These may be had from other ſtatings, as in the ſecond caſe aforeſaid.

PROB. VII.

To take the altitude of a perpendicular object on a hill, from a plane beneath it.

Plate V. fig. 25.

This is done at two ſtations, thus;

Let the height DC, of a wind-mill on a hill be required.

From any part of the plane whence the foot of the object can be ſeen, let angles be taken to the foot and top; meaſure thence any convenient diſtance towards the object, and at the end thereof, take another angle to the top: and you have the proper requiſites, thus;

Firſt ſtation.	Angle to the foot	DAB	21°. 00′.
	Angle to the top	CAB	35°. 00′.
	Stationary diſtance	AB	104 feet.
Second ſtation	Angle to the top		48°. 30′.

DC required.

Geometrically.

On an infinite blank line, lay the ſtationary diſtance AB 104 feet; from A, ſet off the ſecond, and from B, the third given angle; and from the inter-

Plate V. fig. 25.

interfecting point C of the lines formed by them, let fall the perpendicular CE: from A fet off the firft angle, and the line formed by it will determine the point D. Thus have we the height of the hill, as well as that of the wind-mill.

The angle CBE—A = ACB, as in the laft prob.

In the triangle ABC, find AC thus,

S.ACB	:	AB	: :	S.ABC (or fup. of CBE)	:	AC
13°. 30′	:	104	: :	131°. 30′	:	333.6

The angle CAE—DAE = CAD.

The angle ADC = AED + EAD, by theo. 4.

In the triangle CAD, find CD thus,

S.ADC	:	AC	: :	S.CAD	:	DC
111°.	:	333.6	: :	14	:	86.46 required.

CE, BE, or DE, may be found by other various ftatings, as fet forth in the firft and fecond cafes of rectangular trigonometry.

PROB.

Plate V. fig. 26.

PROB. VIII.

To find the length of an object, that ſtands obliquely on the top of a hill, from a plane beneath.

Let CD be a tree whoſe length is required.

This is done at two ſtations.

Make a ſtation at B, from whence take an angle to the foot, and another to the top of the tree; meaſure any convenient diſtance backward to A, from whence alſo let an angle be taken to the foot, and another to the top; and you have the requiſites given. Thus,

First ſtation. Angle to the foot EBD = 36°. 30′.
Angle to the top EBC = 44°. 30′.
Stationary diſtance AB = 104 feet.

Second ſtation. Angle to the foot EAD = 24°. 30′.
Angle to the top EAC = 32°. 00′.

Let DC and DE be required.

The geometrical conſtructions of this and the next problem are omitted; as what has been already ſaid, and the figures are looked upon as ſufficient helps.

EBC—A = ACB, or 44°. 30′—32°. = 12°. 30′, as before.

In

Plate V. fig. 26.

In the triangle ABC, find BC. Thus;

1. S. ACB : AB : : S. A : BC.
   12°. 30′ 104 32° 254.7.

EBD—EAD=ADB, or 36°. 30′—24°. 30′=12° 00′.

In the triangle ADB, find DB. Thus;

2. S. ADB : AB : : S. DAB : DB.
   120. 00′ 104 24°. 30′ 207.4.

CBE—DBE=CBD, or 44°. 30′—36°. 30′=8°. 00′.

In the triangle CBD there is given, CB 254.7, DB 207.4, and the angle CBD 8°. 00′; to find DC.

This is performed as cafe 3, of oblique angular trigonometry, thus;

3. BC+BD : BC—BD : : T. of $\frac{1}{2}$ BDC+BCD :
   462.1. 47.3 86°. 00′.
T. of $\frac{1}{2}$ BDC—BCD.
   55°. 40′.
   86°. 00′ + 55°. 40′ = 141°. 40′ = BDC.
   86°. 00′—55°. 40′ = 30°. 20′ = BCD.

4. S. BCD : BD : : S. CBD : DC.
   30°. 20′ 207.4 8°. 00′ 57.15 length of the tree.

To find DE, in the triangle DBE.

Say R. : BD : : S. DBE : DE.
   90°. 207.4 36°. 30′ 123.4 height of the hill.

PROB.

PROB. IX.

To find the height of an inacceſſible object CD, on a hill BC, from ground that is not horizontal.

Plate VI. fig. 1.

From any two points, as G and A, whoſe diſtance GA, is meaſured, and therefore given; let the angles HGD, BAD, BAC, and EAG, be taken: becauſe GH is parallel to EA (by part 2. theo. 3. ſect. 1.) the angle HGA = EAG; therefore EAG + HGD = AGD: and (by cor. 1. theo. 1. ſect. 1.) 180—the ſum of EAG and BAD = GAD: and (by cor. 1. theo. 5. ſect. 1.) 180—the ſum of the angles AGD and GAD = GDA: thus we have the angles of the triangle AGD, and the ſide AG, given; thence (by caſe 2. of obl. trig.) AD may be eaſily found. The angle DAB—CAB = DAC, and 90°—BAD = ADC; and 180°—the ſum of DAC and ADC = ACD: ſo have we the ſeveral angles of the triangle ACD given, and the ſide AD; whence (by caſe 2. of obl. trig.) CD may be eaſily found. We may alſo find AC, which with the angle BAC, will give CB, the height of the hill.

The ſolutions of the ſeveral problems in heights and diſtances, by Gunter's ſcale, are omitted; becauſe every particular ſtating has been already ſhewn by it, in the rectangular and oblique angular trigonometry.

OF DISTANCES.

ANY of the inſtruments uſed in ſurveying, will give you the angles or bearings of lines; which will be particularly ſhewn, when we come to treat of them.

PROB. I.

Plate VI. fig. 2.

Let A and B be two houſes on one ſide of a river, whoſe diſtance aſunder is 293 perches: there is a tower at C on the other ſide of the river, that makes an angle at A, with the line AB of $53^{\circ}.\ 20'$; and another at B, with the line BA of $66^{\circ}.\ 20'$: required the diſtance of the tower from each houſe, *viz.* AC and BC.

This is performed as caſe 2. of oblique angled trigonometry, thus;

1. S. C	: AB	: : S. A	: BC.
	$60^{\circ}.\ 20'$	293	$53^{\circ}.\ 20'$	270.5.

2. S. C	: AB	: : S. B	: AC.
	$60^{\circ}.\ 20'$	293	$66^{\circ}.\ 20'$	308.8.

PROB.

PROB. II.

Plate VI. fig. 11.

Let B and C, be two houſes whoſe direct diſtance aſunder, BC, is inacceſſible: however it is known that a houſe at A, is 252 perches from B, and 230 from C; and that the angle BAC, is found to be 70°. What is the diſtance BC, between the two houſes?

This is performed as caſe 3. of oblique angular trigonometry, thus;

1. AB + AC : AB—AC : : T. of $\frac{1}{2}$ C + B :
 482 22 . 55°. 00′

T. of $\frac{1}{2}$ C—B
 3°. 44′

55° + 3°. 44′ = 58°. 44′ = C. 55°—3°. 44′ = 51°. 16′ = B.

2. S. C : AB : : S. A : BC.
 58°. 44′ 252 70° 277.

PROB. III.

Plate VI. fig. 3.

Suppoſe ABC a triangular piece of ground, which by an old ſurvey we find to be thus: AB 260, AC 160, BC 150 perches: the mearing lines AC and BC, are deſtroyed or plowed down, and

and the line AB, only remaining. What angles muſt be ſet off at A and B, to run new mearings by, exactly where the old ones were?

This is performed as in caſe 4. of oblique angled trigonometry, thus;

1. AB : AC+BC : : AC—BC : AD—DB.
260 310 10 11.92.

130 + 5.96 = 135.96 = AD.
130 — 5.96 = 124.04 = DB.

2. AD : R : : AC : Sec. A.
136 90° : : 160 31°. 47′.

3. BC : S. A : : AC : S. B.
150 31°. 47′ 160 34°. 10.

PROB. IV.

Plate VI. fig. 4.

Let D and C, be two trees in a bog, to which you can have no nearer acceſs than at A and B: there is given, DAB 100°, CAB 36°. 30′, CBA 121°, DBA 49°, and the line AB 113 perches. Required, the diſtances of the trees DC.

180°—the ſum of DBA and DAB = ADB = 31°.
180°—the ſum of CAB and CBA=ACB=22. 30.

In the triangle ABD, find DB, thus;

1. S. ADB : AB : : S. DAB : DB.
31° 113 : : 100° 216.

And

And in the triangle ABC, find BC, thus;

2. S. ACB : AB : : S. CAB : BC.
$22^\circ\ 30'$ 113 $36^\circ.\ 30'$ 175.6.

In the triangle DBC, you have DBC = ABC — ABD = 72°; likewise the sides BD, BC, as before found, given to find DC.

3. BD+BC : BD—BC : : T. of $\frac{1}{2}$ DCB+CDB:
391.6 40.4 54°

T. of $\frac{1}{2}$ DCB—CDB.
$8^\circ.\ 05'$.

$54^\circ + 8^\circ.\ 05' = 62^\circ.\ 05' =$ DCB.
$54^\circ - 8^\circ.\ 05' = 45^\circ.\ 55' =$ CDB.

4. S. CDB : BC : : S. DBC : DC.
$45^\circ.\ 55'$ 175.6 72° 232.5.

LEMMA.

Plate VI. fig. 10.

If from a point C, of a triangle ABC, inscribed in a circle, there be a perpendicular CD let fall upon the opposite side AB; that perpendicular is to one of the sides, including the angle, as the other side, including the angle, is to the diameter of the circle, i. e. DC : AC : : CB : CE.

Let the diameter CE be drawn and join EB; it is plain the angle CEB = CAB (by cor. 2. theo. 7. sect. 1.) and CBE is a right angle (by cor. 5. theo. 7. sect. 1.) and = ADC: whence ECB = ACD.

ACD. The triangles CEB, CAD, are therefore mutually equiangular, and (by theo. 16. ſect. 1.) DC : AC : : CB : CE, or DC : CB : : AC : CE. Q. E. D.

PROB. V.

Plate VI. fig. 5.

Let three gentlemen's ſeats, A, B, C, be ſituate in a triangular form: there is given, AB 2. 5 miles, AC 2. 3, and BC 2. It is required to build a church at E, that ſhall be equi-diſtant from the ſeats A, B, C. What diſtance muſt it be from each ſeat, and by what angle may the place of it be found?

Geometrically.

By prob. 15. ſect. 1. Find the center of a circle that will paſs through the points A, B, C; and that will be the place of the church; the meaſure of which, to any of theſe points, is the anſwer for the diſtance: draw a line from any of the three points to the center, and the angle it makes with either of the ſides that contain the angle it was drawn to; that angle laid off by the direction of an inſtrument, on the ground, and the diſtance before found, being ranged thereon, will give the place of the church required.

By Calculation.

1. AB : AC + BC : : AC—BC : AD—DB.
   2.5 4.3 .3 .516.

$1.25 + .258 = 1.508 = AD.$

By

By cor. 2. theo. 14. ſect. 1. The ſquare root of the difference of the ſquares of the hypothenuſe AC, and given leg AD, will give DC.

i. e. $5.29 - 2.274064 = 3.015936$.

Its ſquare root is $1.736 = CD$.

Then by the preceding lemma,

2. CD : AC : : CB : the diameter.
   1.736 2.3 2 2.65.

the half of which, *viz.* 1.325 is the ſemi-diameter, or diſtance of the church from each ſeat, that is, AE, CE, BE.

From the center E, let fall a perpendicular upon any of the ſides, as EF, and it will biſect in E: (by theo. 8. ſect. 1.)

Wherefore $AF = CF = \frac{1}{2} AC = 1.15$.

In the right angled triangle AFE, you have AF 1.15, and AE the radius 1.325 given, to find FAE, thus;

3. AF : R. : : AE : Sec. FAE.
   1.15 90° 1.325 29°. 47′.

Wherefore directing an inſtrument to make an angle of 29°. 47′, with the line AC; and meaſuring 1.325 on that line of direction, will give the place of the church, or the center of a circle that will paſs through A, B, and C.

The

The above angle FAE, may be had without a ſecant, as before, thus;

AE : R. : : AF : S. AEF.
1.325 90° 1.15 60°. 13′

Its complement 29°. 47′, will give FAE, as before.

The queſtions that may be propoſed on this head, being innumerable, we have choſen to give only a few of the moſt uſeful.

OF

SECT. III.

Containing a particular Description of the several Instruments used in Surveying, with their respective Uses. And first,

OF THE CHAIN.

THE stationary distance, or mearings of ground, are measured either by Mr. Gunter's chain of four poles or perches, which consists of 100 links; (and this is the most natural division) or by one of 50 links, which contains two poles or perches: but because the length of a perch differs in many places, therefore the lengths of chains and their respective links will differ also.

The *English statute-perch* is $5\frac{1}{2}$ yards, the two-pole chain is 11 yards, and the four-pole one is 22 yards: hence the length of a link in a statute-chain is 7.92 inches.

There are other perches used in different parts of England, as the perch of *wood-land measure*, which is 6 yards; that of *church-land measure*, which is 7 yards (or the same with the *plantation perch)* and the *forest measure perch* which is 8 yards.

The *Irish* or *plantation perch* is 7 yards, as before; the two-pole chain is 14; and the four-pole one is 28 yards: hence the length of a link in a plantation chain is 10.08 inches.

The *Scotch perch* is $18\frac{1}{2}$ feet, or $6\frac{1}{6}$ yards, or 6 Scot's ells. In the ſhire of Cunningham in Scotland, their perch is $18\frac{3}{4}$ feet, and this perch is uſed in ſome few places in the north part of this kingdom, as the ſtatute perch is in ſome other parts.

For the more ready reckoning the links of a four-pole chain, there is a large ring, or ſometimes a round piece of braſs fixed at every 10 links; and at 50 links, or in the middle, there are two large rings. In ſuch chains as have a braſs piece at every 10 links, there is the figure 1 on the firſt piece, 2 on the ſecond, 3 on the third, &c. to 9. By leading therefore that end of the chain forward, which has the leaſt number next it, he who carries the hinder end may eaſily determine any number of links: thus, if he has the braſs piece number 8, next to him, and 6 links more in a diſtance, that diſtance is 86 links. After the ſame manner 10 may be counted for every large ring of a chain which has not braſs pieces on it; and the number of links is thus readily determined.

The two-pole chain has a large ring at every 10 links, and in its middle, or at 25 links, there are 2 large rings; ſo that any number of links may be the more readily counted off, as before.

The ſurveyor ſhould be careful to have his chain meaſured before he proceeds on buſineſs, for the rings

rings are apt to be open by frequent uſing it, and its length is thereby increaſed, ſo that no one can be too circumſpect in this point.

In meaſuring a ſtationary diſtance, there is an object fixed in the extreme point of the line to be meaſured; this is a direction for the hinder chainman to govern the foremoſt one by, in order that the diſtance may be meaſured in a right line; for if the hinder chainman cauſes the other to cover the object, it is plain the foremoſt is then in a right line towards it. For this reaſon it is neceſſary to have a perſon that can be relied on, at the hinder end of the chain, in order to keep the foremoſt man in a right line; and a ſurveyor who has no ſuch perſon, ſhould chain himſelf. The inaccuracies of moſt ſurveys ariſe from bad chaining, that is, from ſtraying out of the right line, as well as from other omiſſions of the hinder chainman: no perſon, therefore, ſhould be admitted at the hinder end of the chain, of whoſe abilities in this reſpect, the ſurveyor was not previouſly ſatisfied and convinced; ſince the ſucceſs of the ſurvey, in a great meaſure, depends on his care and ſkill.

In ſetting out to meaſure any ſtationary diſtance, the fore man of the chain, carries with him 10 iron pegs pointed, each about ten inches long; and when he has ſtretched the chain to its full length, he at the extremity thereof, ſticks one of thoſe pegs perpendicularly in the ground; and leaving it there, he draws on the chain till the hinder man checks him when he arrives at that peg: the chain being again ſtretched, the fore man ſticks down another peg, and the hind man takes up the former; and thus they proceed at every chain's length contained in the line to be meaſured, counting the ſurplus links contained between the laſt

laſt peg, and the object at the termination of the line, as before; ſo that the number of pegs taken up by the hinder chainman, expreſſes the number of chains; to which, if the odd links be annexed, the diſtance line required in chains and links is obtained, which muſt be regiſtered in the field book, as will hereafter be ſhewn.

If the diſtance exceeds 10, 20, 30, *&c.* chains, when the leader's pegs are all exhauſted, the hinder chainman, at the extremity of the 10 chains, delivers him all the pegs; from whence they proceed to meaſure as before, till the leader's pegs are again exhauſted, and the hinder chainman at the extremity of theſe 10 chains again delivers him the pegs; from whence they proceed to meaſure the whole diſtance line in the like manner; then it is plain, that the number of pegs the hinder chainman has, being added to 10, if he had delivered all the pegs once to the leader, or to 20 if twice, or to 30 if thrice, *&c.* will give the number of chains in that diſtance; to which if the ſurplus links be added, the length of the ſtationary diſtance is known in chains and links.

It is cuſtomary, and indeed neceſſary, to have red, or other coloured cloth fixed to the top of each peg, that the hinder man at the chain may the more readily find them; otherwiſe, in chaining thro' corn, high graſs, briars, ruſhes, potatoes, *&c.* it would be extremely difficult to find the pegs which the leader puts down: by this means no time is loſt, which otherwiſe muſt be, if no cloths are fixed to the pegs, as before.

It will be neceſſary here to obſerve, that all ſlant, or inclined ſurfaces, as ſides of hills, are meaſured horizontally, and not on the plane or ſurface of the hill, and is thus effected:

Let

Plate VIII. fig. 4.

Let ABC be a hill, the hindmoſt chainman is to hold the end of the chain perpendicularly over the point A (which he can the better effect with a plummet and line, than by letting a ſtone drop, which is moſt uſual) as *d* is over A, while the leader puts down his peg at *e*: the eye can direct the horizontal poſition near enough, but if greater accuracy were required, a quadrant applied to the chain, would ſettle that. In the ſame manner the reſt may be chained up and down; but in going down it is plain the leader of the chain muſt hold up the end thereof, and the plummet thence ſuſpended, will mark the point where he is to ſtick his peg. The figure is ſufficient to render the whole evident; and to ſhew that the ſum of the chains will be the horizontal meaſure of the baſe of the hill; for $de = Ao$, $fg = op$, $hi = pq$, &c. therefore $de + fg + hi$, &c. $= Ao + op + pq$, &c. $=$ AC, the baſe of the hill. If a whole chain cannot be carried horizontally, half a one, or leſs, may, and the ſum of theſe half chains, or links, will give the baſe, as before.

If the inclined ſide of the hill be a plane ſurface, the angle of the hill's inclination may be taken, and the ſlant height may be meaſured on the ſurface; and thence (by caſe 1. of right angled trigonometry) the horizontal line anſwering to the top, may be found; and if we have the angle of inclination given on the other ſide, with thoſe already given; we can find the horizontal diſtance acroſs the hill, by caſe 2. of oblique trigonometry.

All inclined ſurfaces are conſidered as horizontal ones; for all trees which grow upon any inclined ſurface,

ſurface, do not grow perpendicular thereto, but to the plane of the horizon: thus if *Ad*, *ef*, *gh*, &c. were trees on the ſide of a hill, they grow perpendicular to the horizontal baſe AC, and not to the ſurface AB: hence the baſe will be capable to contain as many trees as are on the ſurface of the hill, which is manifeſt from the continuation of them thereto. And this is the reaſon that the area of the baſe of a hill, is conſidered to be equal in value to the hill itſelf.

Beſides, the irregularities of the ſurfaces of hills in general are ſuch, that they would be found impoſſible to be determined, by the moſt able mathematicians. Certain regular curve ſurfaces have been inveſtigated with no ſmall pains, by the moſt eminent: therefore an attempt to determine in general the infinity of irregular ſurfaces which offer themſelves to our view, to any degree of certainty, would be idle and ridiculous, and for this reaſon alſo, the horizontal area is only attempted.

Again, if the circumjacent lands of a hill be planned or mapped, it is evident we ſhall have a plan of the hill's baſe in the middle: but were it poſſible to put the hill's ſurface in lieu thereof, it would extend itſelf into the circumjacent lands, and render the whole an heap of confuſion: ſo that if the ſurfaces of hills could be determined, no more than the baſe could be mapped.

Roads are uſually meaſured by a wheel for that purpoſe, to which there is fixed a machine, at the end whereof there is a ſpring, which is ſtruck by a peg in the wheel, once in every rotation; by this means the number of rotations is known. If

If ſuch a wheel were 3 feet 4 inches in diameter, one rotation would be $10\frac{1}{2}$ feet, which is half a plantation perch; and becauſe 320 perches make a mile, therefore 640 rotations will be a mile alſo: and the machinery is ſo contrived, that by means of a hand, which is carried round by the work, it points out the miles, quarters, and perches, or ſometimes the miles, furlongs, and perches.

Or roads may be meaſured by a chain more accurately; for 80 four-pole, 160 two-pole chains, or 320 perches, make a mile as before: and if roads are meaſured by a ſtatute chain, it will give you the miles Engliſh, but if by a plantation chain, the miles will be Iriſh. Hence an Engliſh mile contains 1760, and an Iriſh mile 2240 yards; and becauſe 14 half yards is an Iriſh, and 11 half yards is an Engliſh perch, therefore 11 Iriſh perches, or Iriſh miles, are equal to 14 Engliſh ones.

Since ſome ſurveys are taken by a four-pole, and others by a two-pole chain; and as ground for houſes is meaſured by feet, we will ſhew how to reduce one to the other, in the following problems.

PROB. I.

To reduce two-pole chains and links to four-pole ones.

If the number of chains be even, the half of them will be the four-pole ones, to which annex the links given, thus,

1. In

	Ch.	L.	
1. In	16.	37	of two-pole chains, how many four-pole ones?

	Ch.	L.
Anſwer	8.	37.

But if the number of chains be odd, take the half of them for chains, and add 50 to the links, and they will be four-pole chains and links, thus,

	Ch.	L.	
2. In	17.	42	of two-pole chains, how many four-pole ones?

	Ch.	L.
Anſwer	8.	92.

PROB. II.

To reduce four-pole chains and links, to two-pole ones.

Double the chains, to which annex the links, if they be leſs than 50; but if they exceed 50, double the chains, add 1 to them, and take 50 from the links, and the remainder will be the links, thus,

	Ch.	L.	
1. In	8.	37	of four-pole chains, how many two-pole ones?
	2		
	16	37	

2. In

	Ch.	L.	
2. In	8.	82	of four-pole chains, how many
	2.	50	two-pole ones?
	17.	32	Anſwer.

PROB. III.

To reduce four-pole chains and links, to perches and decimals of a perch.

The links of a four-pole chain are decimal parts of it, each link being the hundredth part of a chain; therefore if the chains and links be multiplied by 4 (for 4 perches are a chain) the product will be the perches and decimal parts of a perch. Thus,

	Ch.	L.	
How many perches in	13.	64	of four-pole chains?
		4	
Anſwer	54.	56	perches.

PROB. IV.

To reduce two-pole chains and links, to perches and decimals of a perch.

They may be reduced to four-pole ones (by prob. 1.) and thence to perches and decimals (by the laſt.) or,

If the links be multiplied by 4, carrying one to the chains, when the links are, or exceed 25; and the chains by 2, adding one, if occaſion be: the product will be perches, and decimals of a perch. Thus,

	Ch.	L.	
1. In	17.	21	of two-pole chains, how many
	2.	4	perches?
Anſwer	34.	84	perches.

	Ch.	L.	
2. In	15.	38	of two-pole chains, how many
	2.	4	perches?
Anſwer	31.	52	perches.

PROB. V.

To reduce perches, and decimals of a perch, to four-pole chains and links.

Divide by 4, ſo as to have two decimal places in the quotient, and that will be four-pole chains and links. Thus,

In 31. 52 perches, how many four-pole chains and links?

```
           Ch.  L.
4)31.52(7.  88 Anſwer.
  ----
   35
  ----
   32
  ----
```

PROB.

PROB. VI.

To reduce perches and decimals of a perch, to two-pole chains and links.

The perches may be reduced to four-pole chains (by the laſt) and from thence to two-pole chains (by prob. 2.) or,

Divide the whole number by 2, the quotient will be chains; to the remainder annex the given decimals, and divide by 4, the laſt quotient will be the links. Thus,

In 31.52 perches, how many two-pole chains and links?

```
         Ch.  L.
2)31.52(15.  38 Anſwer.
  ——
  11
  ——
 4)152(38
   ——
   32
   ——
```

PROB. VII.

To reduce chains and links, to feet and decimal parts of a foot.

If they be two-pole chains, reduce them to four-pole ones: (by prob. 1.) theſe being multi-
plied

plied by the feet in a four-pole chain, will give the feet, and decimals of a foot. Thus,

	Ch.	L.	
In	17.	21	of two-pole chains, how many feet?

	Ch.	L.			
	8.	71	of four-pole chains.		
		66	feet = 1 chain.		
		5226.		Feet.	Inches.
	5226		Anſwer	574.	$10\frac{1}{4}$?
Feet	574.86				
		12			
Inches		10.32			
		4			
		1.28			

PROB. VIII.

To reduce feet and inches to chains and links.

Reduce the inches to the decimal of a foot, and annex that to the feet; that divided by the feet in a four-pole chain, will give four-pole chains and links in the quotient: theſe may be reduced to two-pole chains and links, if required, by prob. 2. Thus,

	Feet.	Inches.	
In	217.	9	how many two-pole chains?

12)9.00(.75 the decimal of 9 inches.

60

66)

66)217.75(3. 29 of four-pole chains, or

197

Ch. L.

655 6. 29 of two-pole chains.

61

How to take a Survey by the Chain *only.*

PROB. I.

To ſurvey a piece of ground, by going round it, and the method of taking the angles of the field, by the chain only.

Plate VI. fig. 6.

Let ABCDEFG be a piece of ground to be ſurveyed: beginning at the point A, let one chain be laid in a direct line from A towards G, where let a peg be left, as at *c*; and again, the like diſtance from A in a direct line towards B, where another peg is alſo to be left, as at *d*: let the diſtance from *d* to *c* be meaſured, and placed in the field-book, in the ſecond column under the denomination of angles, in a line with ſtation No. 1; and in the ſame line under the title of diſtances, in the third column, let the meaſure of the line AB in chains and links be inſerted. Being now arrived at B, let one chain be laid in a direct line from B towards A, where let a peg be left, at *f*, and

and again, the like diſtance from B in a direct line towards C, where let alſo another peg be left, as at *e*; the diſtance from *e* to *f* is to be inſerted in the field-book, in the ſecond column, under angles, in a line with ſtation No. 2; and in the ſame line, under the title of diſtances in the third column, let the meaſure of the line BC, in chains and links, be inſerted: after the ſame manner we may proceed from C to D, and thence to E; but becauſe the angle at E, *viz.* FED, is an external angle, after having laid one chain from E to *h*, and to *g*, the diſtance from *g* to *h* is meaſured, and inſerted in the column of angles, in a line with ſtation No. 5. and on the ſide of the field-book againſt that ſtation, we make an aſteriſk, thus *, or any other mark, to ſignify that to be an external angle, or one meaſured out of the ground. Proceed we then as before, from E to F, to G, and thence to A, meaſuring the angles and diſtances, and placing them as before, in the field-book, oppoſite to their reſpective ſtations; ſo will the field-book be completed in manner following.

N. B. After this manner the angles for inacceſſible diſtances may be taken, and the method of conſtructing or laying them down, as well as the conſtruction of the map, from the following field-notes, muſt be obvious from the method of taking them.

The form of the field-book, with the title.

A field-book of part of the land of Grange, in the pariſh of Portmarnock, barony of Coolock, and county of Dublin; being part of the eſtate of L. P. eſq; let to C. D. farmer. Surveyed January, 30, 1788.

Taken

Taken by a four-pole chain.

Remarks.	No. Sta.	Angles. Ch. L.	Diſtances. Ch. L.
Mr. J. D's part of Grange	1	1.80	17.65
	2	1.79	18.50
Mr. L. P's part of Portmarnock	3	1.76	28.00
ſtrand	4	$1.41\frac{1}{2}$	20.00
*	5	$1.87\frac{1}{2}$	14.83
Widow J. G's part of Grange	6	1.14	19.41
	7	1.89	24.53
	Cloſe at the firſt ſtation.		

The ſignification of the remarks.

Mr. J. D's part of Grange bounds, or is adjacent to the ſurveyed land from the firſt to the third ſtation: Mr. L. P's part of Portmarnock bounds it from the third to the fourth ſtation; the ſtrand then is the boundary from thence to the ſixth, and from the ſixth to the firſt ſtation, the widow J. G's part of Grange is the boundary.

It is abſolutely neceſſary to inſert the perſons names, and town-lands, ſtrands, rivers, bogs, rivulets, *&c.* which bound or circumſcribe the land which is ſurveyed, for theſe muſt be expreſſed in the map.

In a ſurvey of a town-land, or eſtate, it is ſufficient to mention only the circumjacent town-lands, without the occupiers names; but when a part only of a town-land is ſurveyed, then it is neceſſary to inſert the perſon or perſons names, who

who hold any particular parcel or parcels of ſuch town-land, as bound the parts ſurveyed.

When an angle is very obtuſe, as moſt in our preſent figure are, *viz.* the angles at A, B, C, E, and G; it will be beſt to lay a chain from the angular point as at A, on each of the containing ſides to *c* and to *d*; and any where nearly in the middle of the angle as at *e*: meaſuring the diſtances *ce* and *ed*; and theſe may be placed for the angle in the field-book. Thus,

No.	Sta.	Angle. Ch. L.	Diſt. Ch. L.
	1	1.03 } 1.09 }	17.65

For when an angle is very obtuſe, the chord line, as *cd*, will be nearly equal to the radii A*c* and A*d*; ſo if the arc *ced* be ſwept, and the chord line *cd* be laid on it, it will be difficult to determine exactly that point in the arc where *cd* cuts it: but if the angle be taken in two parts, as *ce* and *ed*; ſuch chords may with ſafety be laid on the arc, and the angle thence may be truly determined and conſtructed.

After the ſame manner any piece of ground may be ſurveyed by a two-pole chain.

PROB. II.

To take a ſurvey of a piece of ground from any point within it, from whence all the angles can be ſeen; by the chain only.

Let

Plate VI. fig. 6.

Let a mark be fixed at any point in the ground, as at H, from whence all the angles can be feen; let the meafures of the lines HA, HB, HC, &c. be taken to every angle of the field from the point H; and let thofe be placed oppofite to No. 1, 2, 3, 4, &c. in the fecond column of radii: the meafures of the refpective lines of the mearing, *viz.* AB, BC, CD, DE, &c. being placed in the third column of diftances, will complete the field-book. Thus,

Remarks.	No.	Radii. Ch. L.	Diftances. Ch. L.
	1	20.00	17.65
	2	21.72	18.50
	3	21.74	28.00
	4	25.34	20.00
	5	17.20	14.83
	6	29.62	19.41
	7	21.20	24.53
	Clofe at the firft ftation.		

If any line of the field be inacceffible, as fuppofe CD to be, then by way of proof that the diftance CD is true, let the meafure of the angle CHD be taken by the line *oo*, with the chain: if this angle correfponds with its containing fides, the length of the line DC is truly obtained, and the whole work is truly taken.

Note, That in fetting off an angle it is neceffary to ufe the largeft fcale of equal parts, *viz.*

that

that of the inch, which is diagonally divided into 100 parts, in order that the angle ſhould be accurately laid down; or if two inches were thus divided for angles, it would be the more exact; for it is by no means neceſſary that the angles ſhould be laid from the ſaid ſcale with the ſtationary diſtances.

PROB. III.

To take a ſurvey by the chain only, when all the angles cannot be ſeen from one point within.

Plate VI. fig. 7.

Let the ground to be ſurveyed be repreſented by 1, 2, 3, 4, *&c.* Since all the angles cannot be ſeen from one point, let us aſſume 3 points, as A, B, C, from whence they may be ſeen; at each of which let a mark be put, and the reſpective ſides of the triangle be meaſured and ſet down in the field-book; let the diſtances from A to 1, and from B to 1, be meaſured, and theſe will determine the point 1; let the other lines which flow from A, B, C, as well as the circuit of the ground, be then meaſured as the figure directs; and thence the map may be eaſily conſtructed.

There are other methods which may be uſed; as dividing the ground into triangles, and meaſuring the 3 ſides of each; or by meaſuring the baſe and perpendicular of each triangle. But this we ſhall ſpeak of hereafter.

PROB.

PROB. IV.

How to take any inacceſſible diſtance by the chain only.

Plate VIII. fig. 8.

Suppoſe AB to be the breadth of a river, or any other inacceſſible diſtance, which may be required.

Let a ſtaff or any other object be ſet at B, draw yourſelf backward to any convenient diſtance C, ſo that B may cover A: from B, lay off any other diſtance by the river's ſide to E, and complete the parallelogram EBCD: ſtand at D, and cauſe a mark to be ſet at F, in the direction of A; meaſure the diſtance in links from E to F, and FB will be alſo given. Wherefore EF : ED : : FB : AB. Since it is plain (from part 2. theo. 3. ſect. 1. and theo. 2. ſect. 1.) the triangles EFD, BFA, are mutually equi-angular.

If part of the chain be drawn from B to C, and the other part from B to E; and if the ends at E and C be kept faſt, it will be eaſy to turn the chain over to D, ſo as to complete a parallelogram; by reckoning off the ſame number of links you had in BC, from E to D, and pulling each part ſtraight.

OF

OF THE

CIRCUMFERENTOR.

THIS inſtrument is compoſed of a braſs circular box, about five or ſix inches in diameter; within which is a braſs ring, divided on the top into 360 degrees, and numbered 10, 20, 30, *&c.* to 360: in the center of the box is fixed a ſteel pin finely pointed, called a center-pin, on which is placed a needle touched by a loadſtone, which always retains the ſame ſituation; that is, it always points to the North and South points of the horizon nearly, when the inſtrument is horizontal, and the needle at reſt.

The box is covered with a glaſs lid, in a braſs rim, to prevent the needle being diſturbed by wind or rain, at the time of ſurveying: there is alſo a braſs lid or cover, which is laid over the former to preſerve the glaſs in carrying the inſtrument.

This box is fixed by ſcrews, to a braſs index, or ruler, of about 14 or 15 inches in length, to the ends whereof are fixed braſs ſights, which are ſcrewed to the index, and ſtand perpendicular thereto: in each ſight is a large and a ſmall aperture, or ſlit, one over the other; but theſe are changed, that is, if the large aperture be uppermoſt in

in the one ſight, it will be loweſt in the other, and ſo of the ſmall ones: therefore the ſmall aperture in one is oppoſite to the large one in the other; in the middle of which laſt, there is placed a horſe hair, or fine ſilk thread.

The inſtrument is then fixed on a ball and ſocket; by the help of which and a ſcrew, you can readily fix it horizontally in any given direction; the ſocket being fixed on the head of a three-legged ſtaff, whoſe legs when extended, ſupport the inſtrument, whilſt it is uſed.

How to take field-notes by the circumferentor.

Plate VI. fig. 6.

Let your inſtrument be fixed at any angle, as *A*, your firſt ſtation; and let a perſon ſtand at the next angle B, or cauſe a ſtaff, with a white ſheet to be ſet there perpendicularly for an object to take your view to: then having placed your inſtrument horizontally (which is eaſily done by turning the box ſo, that the ends of the needle may be equidiſtant from its bottom, and it traverſes or plays freely) turn the flower-de-luce or north part of the box to your eye, and looking through the ſmall aperture, turn the index about, till you cut the perſon or object in the next angle B, with the horſe hair, or thread of the oppoſite ſight: the degrees then cut by the ſouth end of the needle, will give the number to be placed in the ſecond column of your field-book in a line with ſtation No. 1, and expreſſes the number of degrees the ſtationary line is from the north, counting quite round with the ſun.

Moſt

Moſt needles are pointed at the ſouth end, and have a ſmall ring at the north: ſuch needles are better than thoſe which are pointed at each end, becauſe the ſurveyor cannot miſtake by counting to a wrong end; which error may be frequently committed, in uſing a two-pointed needle.

Two-pointed needles have ſometimes a ring, but more uſually a croſs towards the north end; and the ſouth end is generally bearded towards its extremity, and ſometimes not, but its arm is a naked right line from the cap at the center.

Having taken the degrees or bearing of the firſt ſtationary line AB, let the line be meaſured, and the length thereof in chains and links be inſerted in the third column of your field-book, under the title of diſtances, oppoſite to ſtation No. 1.

It is cuſtomary, and even neceſſary, to cauſe a ſod to be dug up at each ſtation, or place where you fix the inſtrument; to the end, that if any error ſhould ariſe in the field-book, it may be the more readily adjuſted and corrected, by trying over the former bearings and ſtationary diſtances.

Having done with your firſt ſtation, ſet the inſtrument over the hole or ſpot where your object ſtood, as at B, for your ſecond ſtation, and ſend him forward to the next angle of the field, as at C; and having placed the inſtrument in an horizontal direction, with the ſights directed to the object at C, and the north of the box next your eye, count your degrees to the ſouth end of the needle, which regiſter in your field-book, in the ſecond

ſecond column oppoſite to ſtation No. 2; then meaſure the ſtationary diſtance BC, which inſert in the third column, and thus proceed from angle to angle, ſending your object before you, till you return to the place where you began, and you will have the field-book complete; obſerving always to ſignify the parties names who hold the contiguous lands, and the names of the town-lands, rivers, roads, ſwamps, lakes, &c. that bound the land you ſurvey, as before; and this is the manner of taking field-notes by what are called fore-ſights.

But the generality of mearſmen frequently ſet themſelves in diſadvantageous places, ſo as often to occaſion two or more ſtations to be made, where one may do, which creates much trouble and loſs of time: we will therefore ſhew how this may be remedied, by taking back-ſights, thus: let your object ſtand at the point where you begin your ſurvey, as at A; leaving him there, proceed to your next angle B, where fix your inſtrument ſo, that you may have the longeſt view poſſible towards C. Having ſet the inſtrument in an horizontal poſition, turn the ſouth part of the box next your eye, and having cut your object at A, reckon the degrees to the ſouth point of the needle, which will be the ſame as if they were taken from the object to the inſtrument, the direction of the index being the ſame. Let the degree be inſerted in the field-book, and the ſtationary diſtance be meaſured and annexed thereto, in its proper column; and thus proceed from ſtation to ſtation, leaving your object in the laſt point you left, till you return to the firſt ſtation A.

By

By this method your ſtations are laid out to the beſt advantage, and two men may do the buſineſs of three, for one of thoſe who chain, may be your object; but in fore-ſights, you muſt have an object before you, beſides two chainmen.

It was ſaid before, that a ſurveyor ſhould have a perſon with him to carry the hinder end of the chain, on whom he can depend: this perſon ſhould be expert and ready at taking off-ſets, as well as exact in giving a faithful return of the length of every ſtationary line. One who has ſuch a perſon, and who uſes back-ſights, will be able to go over near double the ground he could at the ſame time, by taking fore-ſights. But if a ſurveyor has no ſuch perſon on whom he can with ſafety depend, he muſt take fore-ſights, becauſe of overſeeing the chaining; for ſhould he take back-ſights, he muſt be obliged, after taking his degree, to go back to the foregoing ſtation, to overſee the chaining, and by this means to walk three times over every line, which is a ſlavery not to be borne.

Or a back and a fore-ſight may be taken at one ſtation, thus; with the ſouth of the box to your eye, obſerve from B the object A, and ſet down the degree in your field-book, cut by the ſouth end of the needle. Again, from B obſerve an object at C, with the north of the box to your eye, and ſet down the degree cut by the ſouth point of the needle, ſo have you the bearings of the lines AB and BC; you may then ſet up your inſtrument at D, from whence take a back-ſight to C, and a fore-ſight to E; thus the bearings may be taken quite round, and the ſtationary diſtances being annexed to them, will complete the field-book.

But

But in this laſt method, care muſt be taken to ſee that the ſights have not the leaſt caſt on either ſide; if they have, it will deſtroy all: and yet with the ſame ſights you may take a ſurvey by fore-ſights, or by back-ſights only, with as great truth as if the ſights were ever ſo erect, provided the ſame caſt continues without any alteration; but upon the whole, back-ſights only will be found the readieſt method.

If your needle be pointed at each end, in taking fore-ſights, you may turn the north part of the box to your eye, and count your degrees to the ſouth part of the needle, as before; or you may turn the ſouth of the box to your eye, and count your degrees to the north end of the needle.

But in back-ſights you may turn the north of the box to your eye, and count your degrees to the north point of the needle; or you may turn the ſouth of the box to your eye, and count your degrees to the ſouth end of the needle.

The braſs ring in the box is divided on the ſide into 360 degrees, thus; from the north to the eaſt into 90, from the north to the weſt into 90, from the ſouth to the eaſt into 90, and from the ſouth to the weſt into 90 degrees; ſo the degrees are numbered from the north to the eaſt or weſt, and from the ſouth to the eaſt or weſt.

The manner of uſing this part of the inſtrument is this; having directed your ſights to the object, whether fore or back, as before; obſerve the two cardinal points of your compaſs the point of the

needle lies between (the north, ſouth, eaſt, and weſt being called the four cardinal points, and are graved on the bottom of the box) putting down thoſe points together by their initial letters, and thereto annexing the number of degrees, counting from the north or ſouth, as before, thus; if the point of your needle lies between the north and eaſt, north and weſt, ſouth and eaſt, or ſouth and weſt points in the bottom of the box, then put down NE, NW, SE, or SW, annexing thereto the number of degrees cut by the needle on the ſide of the ring, counting from the north or ſouth, as before.

But if the needle point exactly to the north, ſouth, eaſt, or weſt, you are then to write down N, S, E, or W, without annexing any degree.

This is the manner of taking field-notes, whereby the content of ground may be univerſally determined by calculation; and they are ſaid to be taken by the quartered compaſs, or by the four nineties.

To find the number of degrees, contained in any given angle.

Set up your inſtrument at the angular point, and thence direct the ſights along each leg of the angle, and note down their reſpective bearings as before; the difference of theſe bearings, if leſs than 180, will be the quantity of degrees contained in the given angle; but if more, take it from 360, and the remainder will be the degrees contained in the given angle.

OF

OF THE

THEODOLITE.

THIS inſtrument is a circle, commonly of braſs, of ten or twelve inches in diameter, whoſe limb is divided into 360 degrees, and thoſe again are ſubdivided into ſmaller parts as the magnitude of it will admit; ſometimes by equal diviſions, and ſometimes by diagonals, drawn from one concentric circle of the limb to another.

In the middle is fixed a circumferentor, with a needle; but this is of little or no uſe, except in finding a meridian line, or the proper ſituation of the land.

Over the braſs circle is a pair of ſights, fixed to a moveable index, which turns on the center of the inſtrument, and upon which the circumferentor box is placed.

This inſtrument will either give the angles of the field, or the bearing of every ſtationary diſtance line, from the meridian; as the circumferentor and quartered compaſs do.

First then, *To take the angles of the field.*

Plate VI. fig. 6.

Lay the ends of your index to 360, and 180; turn the whole about with the 360 from you; direct the

the sights from A to G, and screw the instrument fast; direct them from A, to cut the object at B; the degree then cut by that end of the index which is opposite to you, will be the quantity of the angle GAB, to place in your field-book; to which annex the measure of the line AB, in chains and links; set up your instrument at B, unscrew it, and lay the ends of your index to 360, and 180; turn the whole about with the 360 from you, or 180 next you, till you cut the object at A; screw the instrument fast, and direct your sights to the object at C, and the degree then cut by that end of the index which is opposite to you, will be the quantity of the angle ABC. Thus proceed from station to station, still laying the index to 360, turning it from you, and observing the object at the foregoing station, screwing the instrument fast, and observing the object at the following station, and counting the degrees to the opposite end of the index, will give you the quantity of each respective angle.

LEMMA.

All the angles of any polygon, are equal to twice as many right angles as there are sides less by four. Thus, all the angles A, B, C, D, E, F, G, are equal to twice as many right angles, as there are sides in the figure, less by four.

Plate VI. fig. 6.

Let the polygon be disposed into triangles, by lines drawn from any assigned point H within it, as by the lines HA, HB, HC, &c. It is evident then

then (by theo. 5. sect. 1.) that the three angles of each triangle are equal to two right; and consequently, that the angles in all the triangles are twice as many right ones as there are sides: but all the angles about the point H, are equal to four right (by cor. 2. theo. 1. sect. 1.); therefore the remaining angles are equal to twice as many right ones as there are sides in the figure, abating four. Q. E. D.

SCHOLIUM.

Hence we may know if the angles of a survey be truly taken: for if their sum be equal to twice as many right angles, as there are stations, abating four right angles, you may conclude that the angles were truly taken, otherwise not.

If you take the bearing of any line with the circumferentor, that bearing will be the number of degrees the line is from the north; consequently the north must be a like number of degrees from the line, and thus the north, and of course the south, as well as the east and west, or the situation of the land, is obtained.

Secondly, *To take the bearing of each respective line from the meridian; or to perform the office of the circumferentor, or quartered compass by the theodolite.*

Set your instrument at the first station, and lay the index to 360 and 180, with the flower-de-luce of the box next the 360; unscrew the instrument, and turn the whole about, till the north and south points of the needle cut the north and south points in the box; then screw it fast, so is the instrument north and south, abstracted of the variation.

The

The circumferentor box may be then taken off.

Direct the ſights to the object at the ſecond ſtation, and the degree cut by the oppoſite end of the index will be the bearing of that line from the north, and the ſame that the circumferentor would give.

After having meaſured the ſtationary diſtance, ſet up your inſtrument at the ſecond ſtation; unſcrew it, and ſet either end of the index to the degree of the laſt line, and turning the whole about with that degree towards you, direct your ſights to an object at the foregoing ſtation, and ſcrew the inſtrument faſt; it will then be parallel to its former ſituation, and conſequently north and ſouth; direct then your ſights to an object at the following ſtation, and the degree cut by the oppoſite end of the index, will be the bearing of that line.

In like manner you may proceed thro' the whole.

If the braſs circle be divided into four nineties, from 360 and 180, and the letters N, S, E, W, be applied to them; the bearings may be obtained by putting down the letters the far or oppoſite end of the index lies between, and annexing thereto the degrees from the N or S; and this is the ſame as the quartered compaſs.

If you keep the compaſs box on, to ſee the mutual agreement of the two inſtruments; after having fixed the theodolite north and ſouth, as before; turn the index about with the north end or flower-de-luce next your eye, and count the degree to the oppoſite, or ſouth end of the index, and

and this will correſpond with the degree cut by the ſouth end of the needle.

At the ſecond, or next ſtation, unſcrew the inſtrument, and ſet the ſouth of the index to the degree of the laſt ſtation; turn the whole about, with the ſouth of the index to you, and cut the object at the foregoing ſtation; ſcrew the inſtrument faſt, and with the north of the index to you, cut the object at the next following ſtation, the degree then cut by the ſouth of the index, will correſpond with the degree cut by the ſouth end of the needle, and ſo through the whole.

Some theodolites have a ſtanding pair of ſights fixed at 360 and 180, beſides thoſe on the moveable index: if you would uſe both, look through the ſtanding ſights, with the 180 next you, to an object at the foregoing ſtation; ſcrew the inſtrument faſt, and direct the upper ſights on the moveable index, to the object at the following ſtation, and the degree cut by the oppoſite end of the index, will give you the quantity of the angle of the field.

Two pair of ſights can be of no uſe in finding the angles from the meridian; and inaſmuch as one pair is ſufficient to find the angles of the field, the ſecond can be of no uſe: beſides, they obſtruct the free motion of the moveable index, and therefore are rather an incumbrance than of any real uſe. Some will have it, that they are uſeful with the others, for ſetting off a right angle, in taking an off-ſet; and ſurely this is as eaſily performed by the one pair on the moveable index: thus, if you lay the index to 360 and 180, and cut the object either in the laſt or following ſtation, ſcrew the inſtrument

ſtrument faſt, and turn the index to 90 and 270, and then it will be at right angles with the line. So that the ſmall ſights, or thoſe of the circle, can be of no additional uſe to the inſtrument, and therefore ſhould be laid aſide as uſeleſs.

This inſtrument may be uſed in windy and rainy weather, as well as in mountainous and hilly grounds; for it does not require an horizontal poſition to find the bearing, or angle, as the needle doth; and therefore is preferred to any inſtrument that is governed by the needle.

Of the SEMICIRCLE.

THIS inſtrument, as its name imports, is a half circle, divided from its diameter into 180 degrees, and from thence again, that is, from 0, to 360: it is generally made of braſs, and is from 8 to 16 inches diameter.

On the center there is a moveable index with ſights, on which is placed a circumferentor-box, as in the theodolite.

This inſtrument may be uſed as the theodolite in all reſpects; but with this difference, when you are to reckon the degree to that end of the index which is off of the ſemicircle, you may find it at the other end, reckoning the degree from 180 forwards.

Of

OF THE PLANE TABLE.

A PLANE TABLE is an oblong of oak, or other wood, about 15 inches long, and 12 broad; they are generally compoſed of 3 boards, which are eaſily taken aſunder, or put together, for the convenience of carriage.

There is a box frame, with 6 joints in it, to take off and put on as occaſion ſerves; it keeps the table together, and is likewiſe of uſe to keep down a ſheet of paper which is put thereon.

The outſide of the frame is divided into inches and tenths, which ſerve for ruling parallels or ſquares on the paper, or for ſhifting it, when occaſion ſerves.

The inſide of the frame is divided into 360 degrees, which, tho' unequal on it, yet are the degrees of a circle produced from its center, or center of the table, where there is a ſmall hole.

The degrees are ſubdivided as ſmall as their diſtance will admit; at every tenth degree are two numbers, one the number of degrees, the other its complement to 360.

There is another center hole, about $\frac{1}{4}$ of the table's breadth from one edge, and is in the middle between the two ends. To this center hole on the other ſide of the frame, there are the diviſions of a ſemicircle, or 180 degrees; and theſe again are ſubdivided into halves, or quarters, as the ſize of the inſtrument will admit.

That ſide of the frame on which the 360 degrees are, ſupplies the place of a theodolite, the other, that of a ſemicircle.

There is a circumferentor-box of wood, with a paper chart at the bottom, applied to one ſide of the table by a dove-tail joint, faſtened by a ſcrew. This box (beſides its rendering the plane table capable of anſwering the end of a circumferentor) is very uſeful for placing the inſtrument in the ſame poſition every remove.

There is a braſs ruler or index, of about two inches broad, with a ſharp or fiducial edge, at each end of which is a ſight: on the ruler are ſcales of equal parts, with and without diagonals, and a ſcale of chords; the whole is fixed on a ball and ſocket, and ſet on a three-legged ſtaff.

To take the angles of a field by the table.

Having placed the inſtrument at the firſt ſtation, turn it about till the north end of the needle be over the meridian, or flower-de-luce of the box, and there ſcrew it faſt. Aſſign any convenient point, to which apply the edge of the index, ſo as thro' the ſights you may ſee the object in the laſt ſtation, and by the edge of the index from the point draw a line. Again, turn about the index with its edge to the ſame point, and thro' the ſights obſerve the object in the ſecond ſtation, and from the point, by the edge of the index, draw another line; ſo is the angle laid down: on that laſt line ſet off the diſtance to the ſecond ſtation, in chains and links: apply your inſtrument to the ſecond ſtation, taking the angle as before; and after the like manner proceed till the whole is finiſhed.

This

This method may be uſed in good weather, if the needle be well touched and play freely; but if it be in windy weather, or the needle out of order, it is better, after having taken the firſt angle as before, and having removed your inſtrument to the ſecond ſtation, and placed the needle over the meridian line as before, to lay the index on the laſt drawn line, and look backward thro' the ſights; if you then ſee the object in the firſt ſtation, the table is fixed right, and the needle is true; if not, turn the table about, the index lying on the laſt line, till thro' the ſights you ſee the object in the firſt ſtation; and then ſcrew it faſt, and keeping the edge of the index to the ſecond ſtation, direct your ſights to the next; draw a line by the edge of the index, and lay off the next line; and proceed thro' the whole without uſing the needle, as you do with the theodolite.

If the ſheet of paper on the table be not large enough to contain the map of the ground you ſurvey, you muſt put on a clean ſheet, when the other is full; and this is called ſhifting of paper, and is thus performed.

Plate VI. fig. 8.

Let ABCD repreſent the ſheet of paper on the plane table, upon which the plot E, F, G, H, I, K, L, M, is to be drawn; let the firſt ſtation be E, proceed as before from thence to F, and to G; then proceeding to H, you find there is not room on your paper for the line GH; however, draw as much of the line GH, as the paper can hold, or draw it to the paper's edge. Move your inſtrument back to the firſt ſtation E, and proceed the contrary way to M, and to L; but in going from

from thence to K, you again find your ſheet will not hold it; however, draw as much of the line LK on the ſheet, as it can hold.

Take that ſheet off the table, firſt obſerving the diſtance *oo* of the lines GH and LK, by the edge of the table; take off that ſheet, and mark it with No. 1, to ſignify it to be the firſt taken off. Having then put on another ſheet, lay that diſtance *oo* on the contrary end of the table, and ſo proceed as before, with the reſidue of the ſurvey, from *o* to H, to K, and thence to *o*; ſo is your ſurvey complete.

In the like manner you may proceed to take off, and put on, as many ſheets as are convenient; and theſe may afterwards be joined together with mouth glue, or fine white water very thin.

If the index be fixed to the firſt center, uſing the 360 ſide, it will then ſerve as a theodolite, and when to the ſecond center, uſing the 180 ſide, it will ſerve as a ſemicircle; by either of which you may ſurvey in rainy weather, when you cannot have paper on the table.

To

To take an Angle of Altitude by the *Circumſcrentor, Theodolite, Semicircle,* or *Plane Table.*

1. *To take an angle of altitude, by the circumferentor.*

LET the glaſs lid be taken off, and let the inſtrument be turned on one ſide, with the ſtem of the ball into the notch of the ſocket, ſo that the circle may be perpendicular to the plane of the horizon; let the inſtrument be placed in this ſituation before the object, ſo that the top thereof may be ſeen thro' the ſights; let a plummet be ſuſpended from the center pin, and the object being then obſerved, the complement of the number of degrees, comprehended between the thread of the plummet, and that part of the inſtrument which is next your eye, will give the angle of altitude required.

2. If an angle of altitude is to be taken by the theodolite, or ſemicircle, let a thread be run thro' a hole at the center, and a plummet be ſuſpended by it; turn the inſtrument on one ſide, by the help of the ball and notch in the ſocket for that purpoſe, ſo that the thread may cut 90, having 360 degrees next you; ſcrew it faſt in that poſition, and thro' the ſights cut the top of the objects;

objects; and the degrees then cut by the end of the index next you, are the degrees of elevation required. An angle of depreffion is taken the contrary way.

3. By the plane table an angle of altitude is taken in the like manner, by fufpending a plummet from the center thereof, having turned the table on one fide, and fixed the index to the center by a fcrew, fo as to move freely, let the thread cut 90, look thro' the fights as before, and you have the angle of elevation, and on the contrary that of depreffion.

OF

OF THE

PROTRACTOR.

THE protractor is a ſemicircle annexed to a ſcale, and is made of braſs, ivory, or horn; its diameter is generally about five or ſix inches.

The ſemicircle contains three concentric ſemicircles, at ſuch diſtances from each other, that the ſpaces between them may contain figures.

The outward circle is numbered from the right to the left hand, with 10, 20, 30, *&c.* to 180 degrees; the middlemoſt the ſame way, from 180 to 360 degrees; and the innermoſt, from the upper edge of the ſcale both ways, from 10, 20, 30, *&c.* to 90 degrees.

It is eaſy to conceive that the protractor, tho' a ſemicircle, may be made to ſupply the place of a whole circle; for if a line be drawn, and the center-hole of the protractor be laid on any point in that line, the upper edge of the ſcale correſponding with that line, the diviſions on the edge of the ſemicircle will run from 0 to 180, from right to left: again, if it be turned the other way, or downwards, keeping the center-hole thereof on the aforeſaid point in the line, then the diviſions

divifions will run from 180 to 360, and fo completes an entire circle with the former femicircle.

The ufe of the protractor is to lay off angles, and to delineate or draw a map, or plan, of any ground from the field-notes; and is performed in the following manner.

To protract a field-book, when the angles are taken from the meridian.

Plate VI. fig. 9.

On your paper, rule lines parallel to each other, at an inch afunder (being moft ufual) or at any other convenient diftance; on the left end of the parallels put N. for north, and on the right S. for fouth; put E. at the top for eaft, and W. at the bottom of your paper for weft.

Then let the following field-book be that which is to be protracted, the bearings being taken from the meridian, whether by a circumferentor, theodolite, or femicircle, and meafured with a two-pole chain.

No.	Bearing.	Ch. L.
1	$283\frac{1}{2}$	55.20
2	$348\frac{3}{4}$	12.36
3	317	29.20
4	266	55.20
5	193	40.00
6	124	76.00
7	$63\frac{3}{4}$	87.02

Clofe at the firft ftation.

Pitch

Pitch upon any convenient point on your paper, for your firſt ſtation, as at 1, on which lay the center-hole of your protractor, with a protracting-pin; then if the degrees be leſs than 180, turn the arc of your protractor downwards, or towards the weſt; but if more than 180, upwards, or towards the eaſt.

Or if the right-hand be made the north, and the left the ſouth, the weſt will be then up, and the eaſt down.

In this caſe, if the degrees be leſs than 180, turn the arc of your protractor upwards, or towards the weſt; and if more, downwards, or towards the eaſt.

By the foregoing field-book, the firſt bearing is $283\frac{1}{2}$; turn the arc of your protractor upwards, keeping the pin in the center-hole, move the protractor ſo that the parallel lines may cut oppoſite diviſions, either on the ends of the ſcale, or on the degrees, and then it is parallel. This muſt be always firſt done, before you lay off your degrees.

Then by the edge of the ſemicircle keeping the protractor ſteady, with the pin prick the firſt bearing $283\frac{1}{2}$, and from the center-point, thro' that point or prick, draw a blank line with the pin, on which from a ſcale of equal parts, or from the ſcale's edge of the protractor, lay off the diſtance 55C. 20L. ſo is that ſtation protracted.

At

At the end of the firſt ſtation, or at 2, which is the beginning of the ſecond, with the pin place the center of the protractor, turning the arc up, becauſe the bearing of the ſecond ſtation is more than 180, *viz.* $348\frac{3}{4}$. Place your protractor parallel as before, and by the edge of the ſemicircle, with the pin prick at that degree, thro' which and the end of the foregoing ſtation, draw a blank line, and on it ſet the diſtance of that ſtation.

In the like manner proceed thro' the whole, only obſerve to turn the arc of your protractor down, when the degrees are leſs than 180.

If you lay off the ſtationary diſtances by the edge of the protractor, it is neceſſary to obſerve, that if your map is to be laid down by a ſcale of 40 perches to an inch, every diviſion on the protractor's edge will be one two pole chain; $\frac{1}{2}$ a diviſion will be 25 links, and $\frac{1}{4}$ of a diviſion will be $12\frac{1}{2}$ links.

If your map is to be laid down by a ſcale of 20 perches to an inch, two diviſions will be one two-pole chain; one diviſion will be 25 links; $\frac{1}{2}$ a diviſion $12\frac{1}{2}$ links, and $\frac{1}{4}$ of a diviſion will be $6\frac{1}{4}$ links.

In the general, if 25 links be multiplied by the number of perches to an inch, the map is to be laid down by, and the product be divided by 20 (or which is the ſame thing, if you cut off one and take the half) you will have the value of one diviſion on the protractor's edge, in links and parts.

EXAMPLE.

EXAMPLE.

1. How many links in a divifion, if a map be laid down by a fcale of 8 perches to an inch?

$$\begin{array}{r} 25 \\ 8 \\ \hline 2|0)20|0 \\ \hline 10 \end{array}$$ links. Anfwer.

2. How many links in a divifion, if a map be laid down by a fcale of 10 perches to an inch?

$$\begin{array}{r} 25 \\ 10 \\ \hline 2|0)25|0 \\ \hline 12.5 \end{array}$$ or $12\frac{1}{2}$ links. Anfwer.

And fo of any other.

To protract a field-book, taken by the angles of the field.

Note, We here fuppofe the land furveyed is kept on the right hand as you furvey.

Draw a blank line with a ruler of a length greater than the diameter of the protractor; pitch upon any convenient point therein, to which apply the center-hole of your protractor with your pin, turning the arc upwards if the angle be lefs than 180, and downwards if more; and obferve to keep the upper edge of the fcale, or 180 and 0 degrees upon

upon the line: then prick off the number of degrees contained in the given angle, and draw a line from the firſt point through the point at the degrees; upon which lay the ſtationary diſtance. Let this line be lengthened forwards and backwards, keeping your firſt ſtation to the right, and ſecond to the left; and lay the center of your protractor over the ſecond ſtation, with your pin, turning the arc upwards, if the angle be leſs than 180, and downwards, if more; and keeping the 180 and 0 degrees on the line, prick off the number of degrees contained in the given angle, and thro' that point and the laſt ſtation draw a line, on which lay the ſtationary diſtance: and in like manner proceed through the whole.

In all protractions, if the end of the laſt ſtation falls exactly in the point you began at, the field-work and protraction are truly taken, and performed; if not, an error muſt have been committed in one of them: in ſuch caſe make a ſecond protraction; if this agrees with the former, and neither meet or cloſe, the fault is in the field-work, and not in the protraction: and then a re-ſurvey muſt be taken.

SECT.

SECT. IV.

Containing two Methods by which the Areas of right-lined Figures may be determined.

DEFINITION.

THE area or content of any plane ſurface in perches, is the number of ſquare perches, that ſurface contains.

Plate VII. fig. 1.

Let ABCD repreſent a rectangular parallelogram, or oblong: let the ſide AB, or DC, contain 8 equal parts; and the ſide AD, or BC, three of ſuch parts; let the line AB be moved in the direction of AD, till it has come to EF; where AE, or BF (the diſtance of it from its firſt ſituation) may be equal to one of the equal parts. Here it is evident, that the generated oblong ABEF, will contain as many ſquares as the ſide AB contains equal parts, which are 8; each ſquare having for its ſide one of the equal parts, into which AB, or AD, is divided. Again, let AB move on till it comes to GH, ſo as GE, or HF, may be equal to AE, or BF; then it is plain that the oblong AGHB, will contain twice as many ſquares

ſquares as the ſide AB contains equal parts. After the ſame manner it will appear, that the oblong ADCB will contain three times as many ſquares as the ſide AB contains equal parts; and in general, that every rectangular parallelogram, whether ſquare or oblong, contains as many ſquares as the product of the number of equal parts in the baſe, multiplied into the number of the ſame equal parts in the height, contains units, each ſquare having for its ſide one of the equal parts.

Hence ariſes the ſolution of the following problems.

P R O B. I.

To find the content of a ſquare piece of ground.

1. Multiply the baſe in perches, into the perpendicular in perches (or ſquare the baſe) the product will be the content in perches; and becauſe 160 perches make an acre, it muſt thence follow, that

Any area, or content in perches, being divided by 160, will give the content in acres; the remaining perches, if more than 40, being divided by 40, will give the roods, and the laſt remainder, if any, will be perches.

Or thus:

2. Square the ſide in four-pole chains and links, and the product will be ſquare four-pole chains and links; divide this by 10, or cut off one more than the decimals, which are five in all, from the right towards the left: the figures reſting

refting to the left are acres, becaufe 10 fquare four-pole chains make an acre, and the remaining figures are decimal parts of an acre. Multiply the five figures to the right by 4, cutting 5 figures from the product, and if any figure be to the left of them, it is a rood, or roods; multiply the laft cut off figures by 40, cutting off five, or (which is the fame thing) by 4, cutting off four; and the remaining figures to the left, if any, are perches.

1. The firft part is plain, from confidering that a piece of ground in a fquare form, whofe fide is a perch, muft contain a perch of ground; and that 40 fuch perches make a rood, or ftang, and four roods an acre; or which is the fame thing, that 160 fquare perches make an acre, as before.

2. A fquare four-pole chain (that is, a piece of ground four poles or perches every way) muft contain 16 fquare perches; and fince 160 perches make an acre, therefore 10 times 16 perches, or 10 fquare four-pole chains make an acre.

Note, That the chains given, or required, in any of the following problems, are fuppofed two-pole chains, that chain being moft commonly ufed; but they muft be reduced to four-pole chains or perches for calculation, becaufe the links will not operate with them as decimals.

E X A M P L E S.

Plate I. fig. 17.

Let ABCD be a fquare field, whofe fide is 14. 29 (Ch. L.); I demand the content in acres.

By

By problem 4. ſection 3. Ch. L. 14.29 are equal to 29.16 perches.

```
 29.16
 29.16
 -----
 17496
 2916
26244
5832
--------             A.  R.  P.
160)850.3056(5.  1.  10. content.
---
40)50(1 rood.
--
10 perches.
```

Or thus:

Ch. L. 14.29 are equal to Ch. L. 7. 29 of four-pole chains, by prob. 1. ſect. 3.

```
                7. 29
                7. 29
                -----
                 6561
                1458
               5103
               ------                A. R. P.
Acres         5|31441 content as before 5. 1. 10.
                    4
               ------
Rood          1|25764
                    4
               ------
Perches      10|3056
```

It is required to lay down a map of this piece of ground, by a ſcale of twenty perches to an inch.

Take

Take 29.16 the perches of the given ſide, from the ſmall diagonal on the common ſurveying ſcale, where 20 ſmall, or two of the large diviſions are an inch; make a ſquare whoſe ſide is that length (by prob. 9. ſect. 1.) and it is done.

PROB. II.

To find the ſide of a ſquare, whoſe content is given.

Extract the ſquare root of the given content in perches, and you have the ſide in perches, and conſequently in chains.

EXAMPLE.

It is required to lay out a ſquare piece of ground which ſhall contain 12A. 3R. 16P. Required the number of chains in each ſide of the ſquare; and to lay down a map of it, by a ſcale of 40 perches to an inch.

```
 A.  R.  P.
12.  3.  16.
 4
----
 51
 40
----                        Ch.  L.
2056(45.34 perches = 22. 33½, by prob. 6.
----
85)456                      [ſect. 3.
------
903)3100
-------
9064)39100
--------
```

To draw the map.

From a ſcale where 4 of the large, or 40 of the ſmall diviſions are an inch, take 45.34, the perches of the ſide, of which make a ſquare.

PROB. III.

To find the content of an oblong piece of ground.

Multiply the length by the breadth, for the content.

EXAMPLE.

Plate I. fig. 3.

Let ABCD be an oblong piece of ground, whoſe length AB is 14C. 25L. and breadth 8C. 37L. I demand the content in acres, and alſo to lay down a map of it, by a ſcale of 20 perches to an inch.

Ch. L.		Perches.	
14.25	=	29.00	By prob. 4. ſect. 3.
8.37	=	17.48	

15732
3496

A. R. P.
160)506.9200(3. 0. 27. content.

26 perch, or near 27.

Or

Or thus:

4 pole ch.		
Ch. L.	Ch. L.	
14.25 =	7.25	By prob. 1. ſect. 3.
8.37 =	4.37	
	5075	
	2175	
	2900	
Acres	3|16825	
	4	
Rood	|67300	
	4	
Perches	26|9200	

To draw the map.

Make an oblong (by ſchol. to prob. 9. ſect. 1.) whoſe length, from a ſcale of 20 to an inch, may be 29 perches, and breadth, 17.48 perches.

PROB. IV.

The content of an oblong piece of ground, and one ſide given, to find the other.

Divide the content in perches, by the given ſide in perches, the quotient is the required ſide in perches; and thence it may be eaſily reduced to chains.

EXAMPLE.

EXAMPLE.

There is a ditch 14 Ch. 25 L. long, by the ſide of which it is required to lay out an oblong piece of ground, which ſhall contain 3A. 0R. 27P: what breadth muſt be laid off at each end of the ditch, to encloſe the 3A. 0R. 27P?

```
 A. R. P.
 3. 0. 27.
 4
 ——
 12
 40
 ———        Perch.    Ch. L.
29)507(17.48 = 8. 37 breadth.
   ———
   217
   ———
    140
   ———
    240
   ———
      8
   ———
```

The map is done as the laſt.

PROB. V.

To find the content of a piece of ground, in form of an oblique angular parallelogram; or of a rhombus, or rhomboides.

Multiply the baſe into the perpendicular height. The reaſon is plain from theo. 13. ſect. 1.

EXAMPLE.

EXAMPLE.

Plate VII. fig. 2.

Let ABCD be a piece of ground in form of a rhombus, whofe bafe AB is 22 chains, and perpendicular DE, or FC, 20 chains. Required the content.

$$\begin{array}{ll} \text{Ch.} & \text{Ch.} \\ 22 = & 11.0 \\ 20 = & 10.0 \end{array}\Big\}\ \text{4 pole chains.}$$

$$\text{Acres } \underline{11|0}$$

Or,

$$\begin{array}{l} \text{Ch.} \\ 22 = 44 \\ 20 = 40 \end{array}\Big\}\ \text{perches.}$$

$$160)1760(11 \text{ acres.}$$
$$\underline{160}$$

The converfe of this is done by prob. 4. and the map is drawn, by laying of the perpendicular on that part of the bafe from whence it was taken: joining the extremity thereof to that of the bafe, by a right line, and thence complete the parallelogram.

PROB.

P R O B. VI.

To find the content of a triangular piece of ground.

Multiply the baſe by half the perpendicular, or the perpendicular by half the baſe; or take half the product of the baſe into the perpendicular.

The reaſon hereof is plain, from cor. 2. theo. 12. ſect. 1.

E X A M P L E.

Plate I. fig. 16.

Let ABC be a triangular piece of ground, whoſe longeſt ſide or baſe BC, is 24C. 38L. and perpendicular AD, let fall from the oppoſite angle, is 13 C. 28L. Required the content.

	Ch.	L.		Ch.	L.	
1. Baſe	24.	38	=	12.	38	4 pole chains.
		½ perp.		3.	39	

```
        11142
       3714
      3714
Acres 4|19682
         4
Rood   |78728
         40
Perches 31|4912
```

	A.	R.	P.
Content	4.	0.	31.

Perp.

	Ch. L.		Ch. L.	
Perp.	13.28	=	6.78	four-pole chains, by prob.
$\frac{1}{2}$perp.	6.39	=	3.39	1. sect. 3.

Or 2dly. Perp. 6.78 of four-pole chains.
$\frac{1}{2}$base 6.19

6102
678
4068

A. R. P.
4|19682 = 4. 0. 31.

Or 3dly. Base 12.38 four-pole chains.
Perp. 6.78

9904
8666
7428

83.9364

A. R. P.
Its $\frac{1}{2}$ = 4|19682 = 4. 0. 31.

Or the base and perpendicular may be reduced to perches; and the content may be thence obtained, thus:

Perp.

	Ch. L.		Perches.	
Perp.	13.28	=	27.12	By prob. 4. sect. 3.
Half the perp.			13.56	

		Perches.		Ch. L.
1.	Base	49.52	=	24.38
	$\frac{1}{2}$ perp.	13.56		

```
     29712
    24760
   14856
   4952
   ---------  A.  R.  P.
160)671.4912(4. 0. 31.
   ------
    31
   ------
```

Perches.

```
2.      Perp.  27.12
   Half base   24.76
               -----
               16272
              18984
             10848
             5424
             ---------   A. R. P.
             671.4912 = 4. 0. 31.
```

But, square perches may be reduced to acres, &c. rather more commodiously, by dividing by 40 and 4, than by 160; thus,

```
 4|0)67|1.
    ------
   4)16. 31
    --------
   A. 4. 0. 31.
```

3. Base

		Perch.
3.	Base	49.52
	Perp.	27.12

```
      9904
     4952
    34664
    9904
  ---------
  1342.9824
  ---------          A.  R.  P.
   671.4912 = 4.  0.  31.
```

The map may be readily drawn, having the distance from either end of the base, to the perpendicular given; as may be evident from the figure.

PROB. VII.

The content of a triangular piece of ground, and the base given, to find the perpendicular.

Divide the content in perches, by half the base in perches; and the quotient will give you the perpendicular in perches, and so in chains.

EXAMPLES.

Plate I. fig. 16.

Let BC be a ditch, whose length is 24C. 40L. by which it is required to lay out a triangular piece of ground, whose content shall be 4A. 1R. 10P. Required the perpendicular.

	Ch. L.		Perches.
Bafe	24.40	=	49.6
Half the bafe		=	24.8

```
      A.  R.  P.
      4.  1.  10.
      4
     ----
     17
     40
    ----  Perches.
24.8)690(27.82
     ----
     1940
     ----
     2040
     ----
      560
     ----
       64
     ----
```

	Perches.		Ch. L.
Anfwer perp.	27.82	=	13.45.

This perpendicular being laid on any part of the bafe, and lines run from its extremity to the ends of the bafe, will lay out the triangle (by cor. to theo. 13. fect. 1.) fo that the perpendicular may be fet on that part of the bafe which is moft convenient and agreeable to the parties concerned.

LEMMA.

LEMMA.

If from half the ſum of the ſides of any plane triangle ABC, each particular ſide be taken; and if the half ſum, and the three remainders be multiplied continually into each other, the ſquare root of this product will be the area of the triangle.

Plate VIII. fig. 9.

Biſect any two of the angles, as A and B, with the lines AB, BD meeting in D; draw the perpendiculars DE, DF, DG.

The triangle AFD is equiangular to AED; for the angle FAD = EAD by conſtruction, and AFD = AED, being each a right angle, and of conſequence ADF = ADE; wherefore AD : DF : : AD : DE : and ſince AD bears the ſame proportion to DF, that it doth to DE, DF = DE, and the triangle AFD = AED. The ſame way DE = DG, and the triangle DEB = DGB, and FD = DE = DG; therefore D will be the center of a circle that will paſs through E, F, G.

In the ſame way if A and C were biſected, the ſame point D would be had; therefore a line from D to C will biſect C, and thus the triangles DFC, DGC will be alſo equal.

Produce CA to H, till AH = EB or GB; ſo will HC be equal to half the ſum of the ſides, *viz.* to $\frac{1}{2}$ AB, + $\frac{1}{2}$ AC + $\frac{1}{2}$ BC; for FC, FA, EB, are ſeverally equal to CG, AE, BG; and all theſe together are equal to the ſum of the ſides of the triangle; therefore FC + FA + EB or CH, are equal to half the ſum of the ſides.

FC

FC = CH—AB, for AF = AE, and HA = EB; therefore HF = AB; and AF = CH—BC; for CF =CG, and AH = GB; therefore BC = HA + FC, and AH = CH—AC.

Continue DC, till it meets a perpendicular drawn upon H, in K; and from K draw the perpendicular KI, and join AK.

Becaufe the angles AHK and AIK are two right ones, the angles HIA and K together, are equal to two right; fince the angles of the two triangles contain four right: in the fame way FDE + FAE = (2 right angles =) FAE + IAH; let FAE be taken from both, then FDE = IAH, and of courfe FAE = K: the quadrilateral figures AFDE, and KHAI, are therefore fimilar, and have the fides about the equal angles proportional; and it is plain the triangles CFD and CHK are alfo proportional: hence,

FD : HA : : FA : HK
FD : FC : : HK : HC

Wherefore by multiplying the extremes, and means in both, it will be the fquare of FD × HK × HC = FC × FA × HA × HK; let HK be taken from both, and multiply each fide by CH; then the fquare of CH × by the fquare of FD = FC × FA × HA × CH.

It is plain, by the foregoing problem, that $\frac{1}{2}$ AB × DE, + $\frac{1}{2}$ BC × DG + $\frac{1}{2}$ AC × FD = the area of the triangle; or that half the fum of the fides, *viz.* CH × FD = the triangle; wherefore the fquare of CH × by the fquare of FD = FC ×

FA

FA × HA × CH, that is, the half ſum multiplied continually into the differences between the half ſum and each ſide, will be the ſquare of the area of the triangle, and its root the area. Q. E. D.

Hence the following problem will be evident.

P R O B. VIII.

The three ſides of a plane triangle given, to find the area.

R U L E.

From half the ſum of the three ſides ſubtract each ſide ſeverally; take the logarithms of the half ſum and three remainders, and half their total will be the logarithm of the area: or, take the ſquare root of the continued product of the half ſum and three remainders for the area.

E X A M P L E S.

Plate VIII. fig. 9.

1. *In the triangle ABC, are*

Given, $\begin{cases} AB = 10.64 \\ AC = 12.28 \\ BC = 9.00 \end{cases}$ four pole chains; required the area?

Sum	31.92		
Half ſum	15.96	Log.	1.20303
Remainders	5.32	—	0.72591
	3.68	—	0.56585
	6.96	—	0.84261
			2)3.33740
Anſwer, Sqr. Ch.	46.63	Log.	1.66870
or,	4.663	Acres.	

Or,

Or, $15.96 \times 5.32 \times 3.68 \times 6.96 = 2174.71113216$; the ſquare root of which is 46.63, for the area as before.

2. What quantity of land is contained in a triangle, the 3 ſides of which are, 80, 120 and 160 perches reſpectively? Anſwer 29A. 7P.

PROB. IX.

Two ſides of a plane triangle and their included angle given, to find the area.

RULE.

To the log. ſine of the given angle (or of its ſupplement to 180°, if obtuſe) add the logarithms of the containing ſides; the ſum, leſs radius, will be the logarithm of the double area.

EXAMPLES.

Plate V. fig. 16.

Suppoſe two ſides, AB, AC, of a triangular lot ABC, form an angle of 30 degrees, and meaſure, one 64 perches, and the other 40.5, what muſt the content be?

Given angle	30°.	ſine	9.69897
Containing ſides	64.	log.	1.80618
	40.5	log.	1.60745
	2)1296.	log.	3.11260
	160)648(4A. 8P. anſwer.		
	8		

2. Required

2. Required the area of a triangle, two ſides of which are, 49.2 and 40.8 perches, and their contained angle $144\frac{1}{2}$ degrees? Anſwer, 3A. 2R. 22P.

3. What quantity of ground is incloſed in an equilateral triangle, each ſide of which is 100 perches, either angle being 60 degrees? Anſwer, 27A. 10P.

Demonſtration of this problem.

Plate XI. fig. 3.

Let AH be perpendicular to AB and equal to AC, and HE, FCG, parallel to AB; then, making AH (= AC) radius, AF (= CD) will be the ſine of CAD, and the parallelograms ABEH (the product of the given ſides) and ABGF (the double area of the triangle) having the ſame baſe AB, are in proportion as their heights AH, AF; that is, as radius to the ſine of the given angle; which proportion gives the operation as in the rule above. Q. E. D.

P R O B. X.

To find the area of a trapezoid, viz. a figure bounded by four right-lines, two of which are parallel, but unequal.

R U L E.

Multiply the ſum of the parallel ſides by their perpendicular diſtance, and take half the product for the area.

E X A M P L E S.

1. Required the area of a trapezoid, of which the parallel ſides are, reſpectively, 30 and 49 perches, and their perpendicular diſtance 61.6?

61.6

Note. On this 10th problem are founded moſt of the calculations of differences by latitude and departure, and thoſe by off-ſets, following in this treatiſe.

$$\left.\begin{array}{r} 61.6 \\ 30+49=79. \end{array}\right\}\text{Multiply.}$$

$$2)4866.4$$

Anfwer, $2433.2 = 15A.\ 33.2P.$

Plate VIII. fig. 10.

2. In the trapezoid ABCD the parallel fides are, AD, 20 perches, BC, 32, and their perpendicular diftance, AB, 26; required the content?

Anfwer, 4A. 36P.

P R O B. XI.

To find the content of a trapezium.

R U L E.

Multiply the diagonal, or line joining the remoteft oppofite angles, by the fum of the two perpendiculars falling from the other angles to that diagonal, and half the product will be the area.

E X A M P L E.

Plate VII. fig. 3.

Let ABCD be a field in form of a trapezium, the diagonal AC 64.4 perches, the perpendicular B*b* 13.6 and D*d* 27.2, required the content?

$$\left.\begin{array}{r} \text{Diagonal} = 64.4 \\ 13.6+27.2=40.8 \end{array}\right\}\text{Multiply.}$$

$$2)2627.52$$

$$160)1313.76(8A.\ 33\tfrac{3}{4}P.\ \text{Anfwer.}$$
$$1280$$

$$33\tfrac{3}{4}\ \text{perches.}$$

Note.

Note. The method of multiplying together the half sums of the opposite sides of a trapezium for the content is erroneous, and the more so the more oblique its angles are.

To draw the map; set off A*b* 28 perches and A*d* 34.4, and there make the perpendiculars to their proper lengths, and join their extremities to those of the diagonal.

P R O B. XII.

To find the area of a circle, or an ellipsis.

R U L E.

Multiply the square of the circle's diameter, or the product of the longest and shortest diameters of the ellipsis by .7854 for the area. Or, subtract 0.10491 from the double logarithm of the circle's diameter, or from the sum of the logarithms of those elliptic diameters, and the remainder will be the logarithm of the area.

Note. In any circle, the

$$\left.\begin{array}{l}\text{Diam. multi.}\\ \text{Circum. div.}\end{array}\right\}\text{ by } 3.14159, \left\{\begin{array}{l}\text{produces the Cir.}\\ \text{quotes the diam.}\end{array}\right.$$

E X A M P L E S.

1. How many acres are in a circle of a mile diameter?

1 Mile = 320 per.	log.	2.50515
		2.50515
		5.01030
		0.10491
4|0)8042|5.	log.	4.90539
4)2010.25		
Answer, 502A. 2R. 25P.		

2. A gentleman, knowing that the area of a circle is greater than that of any other figure of equal perimeter, walls in a circular deer-park of 100 perches diameter, in which he makes an elliptical fish-pond 10 perches long by 5 wide; required the length of his wall, content of his park, and area of his pond?

Answer, the wall 314.16 perches, inclosing 49A. 14P. of which $39\frac{1}{4}$ perches, or $\frac{1}{4}$ of an acre nearly, is appropriated to the pond.

PROB. XIII.

The area of a circle given, to find its diameter.

Rule.

To the logarithm of the area add 0.10491, and half the sum will be the logarithm of the diameter. Or, divide the area by .7854 and the square-root of the quotient will be the diameter.

Example.

A horse, in the midst of a meadow suppose,
Made fast to a stake by a line from his nose,
How long must this line be, that, feeding all round,
Permits him to graze just an acre of ground?

Area in perches 160	log.	2.20412
		0.10491
		2)2.30903
2)		
Diameter 14.2733	log.	1.15451

Answer, 7.13665 per. = 117F. 9In.

PROB.

PROB. XIV.

To make the proper allowance for roads.

It is cuſtomary to deduct 6 acres out of 106 for roads: the land before the deduction is made may be termed the *groſs*, and that remaining after ſuch deduction, the *neat*.

RULE.

The groſs div. } by 1.06, } quotes the neat.
The neat mul. } by 1.06, } prod. the groſs.

EXAMPLES.

1. How much land muſt I incloſe to have 850 A. 2 R. 20 P. neat?

40|20.
4| 2.5

	Acres.	A.	R.	P.	
850.625 × 1.06 =	901.6625 =	901.	2.	26.	the anſ.

2. How much neat land is there in a tract of 901 A. 2 R. 26 P. groſs?

40|26.
4| 2.65

	Acres.	A.	R.	P.	
1.06)901.6625(	850.625 =	850.	2.	20.	the anſw.

848

&c.

Note. Theſe two operations prove each other.

PROB.

P R O B. XV.

To find the area of a piece of ground, be it ever ſo irregular, by dividing it into triangles and trapezia.

Plate VII. fig. 4.

We here admit the ſurvey to be taken, and protracted; by having therefore the map, and knowin the ſcale by which it was laid down, the content may be thus obtained.

Diſpoſe the given map into triangles, by fine pencilled lines, ſuch as are here repreſented by pop'd lines in the ſcheme, and number the triangles with 1, 2, 3, 4, *&c.* Your map being thus prepared, rule a table with four columns; the firſt of which is for the number of the triangle, the ſecond for the baſe of it, the third for the perpendicular, and the fourth for the content in perches.

Then proceed to meaſure the baſe of number 1. from the ſcale of perches the map was laid down, and place that in the ſecond column of the table, under the word baſe; and from the angle oppoſite to the baſe, open your compaſſes ſo, as when one foot is in the angular point, the other being moved backwards and forwards, may juſt touch the baſe line, and neither go the leaſt above or beneath it; that diſtance in the compaſſes, meaſured from the ſame ſcale, is the length of that perpendicular, which place in the third column, under the word perpendicular.

If

If the perpendiculars of two triangles fall on one and the ſame baſe, it is unneceſſary to put down the baſe twice, but inſert the ſecond perpendicular oppoſite to the number of the triangles in the table, and join it with the other perpendicular by a brace, as No. 1 & 2, 4 & 5, 6 & 7, 9 & 10, *&c.*

Proceed after this manner, till you have meaſured all the triangles; and then by prob. 6. find the content in perches of each reſpective triangle, which ſeverally place in the table oppoſite to the number of the triangle, in the fourth column, under the word content.

But where two perpendiculars are joined together in the table, by a brace, having both one and the ſame baſe; find the content of each (being a trapezium) in perches, by prob. 11. which place oppoſite the middle of thoſe perpendiculars, in the fourth column, under the word content.

Having thus obtained the content of each reſpective triangle and trapezium, which the map contains, add them all together, and their ſum will be the content of the map in perches; which being divided by 160, gives the content in acres. Thus, for

EXAMPLE.

EXAMPLE.

No.	Bafe.	Perpend.	Content
1	24.8	17.0	412.92
2		16.3	
3	28.2	16.0	225.6
4	39.8	19.6	712.42
5		16.2	
6	49.4	29.0	1086.8
7		15.0	
8	38.7	6.7	129.64
9	40.0	17.0	600.
10		13.0	
11	42.8	10.2	481.5
12		12.3	
13	26.2	17.9	234.49
14	24.0	11.6	259.2
15		10.0	

Content in perches 4142.57

This being divided by 160, will give 25A. 3R. 22P. the content of the map.

Let your map be laid down by the largeft fcale your paper will admit, for then the bafes and perpendiculars can be meafured with greater accuracy than when laid down by a fmaller fcale; and if poffible meafure from fcales divided diagonally.

If the bafes and perpendiculars were meafured by four-pole chains, the content of every triangle and trapezium, may be had as before, in problems

lems 6. and 11. and consequently the whole content of the map.

If any part of your map has short or crooked bounds, as those represented in plate VII. fig. 5. then by the straight edge of a transparent horn, draw a fine pencilled line as AB, to balance the parts taken in and left out, as also another, BC: these parts when small, may be balanced very nearly by the eye, or they may be more accurately balanced by method the third. Join the points A and C by a line, so will the content of the triangle ABC, be equal to that contained between the line AC, and the crooked boundary from A to B, and to C: by this method the number of triangles will be greatly lessened, and the content become more certain; for the fewer operations you have, the less subject will you be to err; and if an error be committed, the sooner it may be discovered.

The lines of the map should be drawn small, and neat, as well as the bases; the compasses neatly pointed, and scale accurately divided; without all which, you may err greatly. The multiplications should be run over twice at least, as also the addition of the column content.

From what has been said, it will be easy to survey a field, by reducing it into triangles, and measuring the bases and perpendiculars by the chain. To ascertain the content only, it is not material to know at what part of the base the perpendicular was taken: since it has been shewn (in cor. to theo. 13. sect. 1.) that triangles on the same base, and between the same parallels are equal: but if you would draw a map from the bases and perpendiculars, it is evident that you must know at what

what part of the bafe the perpendicular was taken, in order to fet it off in its due pofition; and hence the map is eafily conftructed.

P R O B. XVI.

To determine the area of a piece of ground, having the map given, by reducing it to one triangle equal thereto, and thence finding its content.

Plate VIII. fig. 5.

Let A B C D E F G H be a map of ground, which you would reduce to one triangle equal thereto.

Produce any line of the map, as AH, both ways; lay the edge of a parallel ruler from A to C, having B above it; hold the other fide of the ruler, or that next you faft; open till the fame edge touches B, and by it, with a protracting pin, mark the point *b* on the produced line; lay the edge of the ruler from *b* to D, having C above it; hold the other fide faft, open till the fame edge touches C, and by it mark the point *c*, on the produced line. A line drawn from *c* to D will take in as much as it leaves out of the map.

Again, lay the edge of the ruler from H to F, having G above it, keep the other fide faft, open till the fame edge touches G, and by it mark the point *g*, on the produced line; lay the edge of the ruler from *g* to E, having F above it, keep the other fide faft, open till the fame edge touches F, and by it mark the point *f*, on the produced line. Lay the edge of the ruler from *f* to D, having E above it, keep the other fide faft,

open

open till the ſame edge touches E, and by it mark the point *e*, on the produced line. A line drawn from D to *e*, will take in as much as it leaves out. Thus have you the triangle *c* D *e*, equal to the irregular polygon A B C D E F G H.

If when the ruler's edge be applied to the points A and C, the point B falls under the ruler, hold that ſide next the ſaid points faſt, and draw back the other to any convenient diſtance; then hold this laſt ſide faſt, and draw back the former edge to B, and by it mark *b*, on the produced line; and thus a parallel may be drawn to any point under the ruler, as well as if it were above it. It is beſt to keep the point of your protracting pin in the laſt point in the extended line, till you lay the edge of the ruler from it to the next ſtation, or you may miſtake one point for another.

This may alſo be performed with a ſcale, or ruler, which has a thin ſloped edge, called a fiducial, or ſure edge; and a fine pointed pair of compaſſes. Thus,

Lay that edge on the points A and C, take the diſtance from the point B to the edge of the ſcale, ſo that it may only touch it, in the ſame manner as you take the perpendicular of a triangle; carry that diſtance down by the edge of the ſcale parallel to it, to *b*; and there deſcribe an arc on the point *b*, and if it juſt touches the ruler's edge, the point *b* is in the true place of the extended line. Lay then the fiducial edge of the ſcale from *b* to D, and take a diſtance from C, that will juſt touch the edge of the ſcale; carry that diſtance

tance along the edge, till the point which was in C, cuts the produced line in *c*; keep that foot in *c*, and defcribe an arc, and if it juft touches the ruler's edge, the point *c* is in the true place of the extended line. Draw a line from *c* to D, and it will take in and leave out equally: in like manner the other fide of the figure may be balanced by the line *e* D.

Let the point of your compaffes be kept to the laft point of the extended line, till you lay your fcale from it to the next ftation, to prevent miftakes from the number of points.

That the triangle *c* D *e*, is equal to the right-lined figure A B C D E F G H, will be evident from problems 18. 19. fect. 1. for thereby, if a line were drawn from *b* to C, it will give and take equally, and then the figure *b* C D E F G H, will be equal to the map. Thus the figure is leffened by one fide, and by the next balance line will leffen it by two, and fo on, and will give and take equally. In the fame manner an equality will arife on the other fide.

The area of the triangle is eafily obtained, as before, and thus you have the area of the map.

It is beft to extend one of the fhorteft lines of the polygon, becaufe if a very long line be produced, the triangle will have one angle very obtufe, and confequently the other two very acute; in which cafe it will not be eafy to determine exactly the

the length of the longeſt ſide, or the points where the balancing lines cut the extended one.

This method will be found very uſeful and ready in ſmall encloſures, as well as very exact; it may be alſo uſed in large ones, but great care muſt be taken of the points on the extended line, which will be crowded, as well as of not miſſing a ſtation.

PROB. XVII.

A Map with its area being given, and its ſcale omitted to be either drawn or mentioned; to find the ſcale.

CAST up the map by any ſcale whatſoever, and it will be,

As the area found
Is to the ſquare of the ſcale by which you caſt up,
: : The given area of the map
To the ſquare of the ſcale by which it was laid down.

The ſquare root of which will give the ſcale.

EXAMPLE.

A map whoſe area is 126A. 3R. 16P. being given; and its ſcale omitted to be either drawn or mentioned; to find the ſcale.

Suppoſe this map was caſt up by a ſcale of 20 perches to an inch, and the content thereby produced be 31A. 2R. 34P.

As

As the area found, 31A. 2R. 34P. = 5074P.
Is to the ſquare of the ſcale by which it was caſt up, that is, to 20 × 20 = 400,
: : The given area of the map 126A. 3R. 16P. = 20296P.
To the ſquare of the ſcale by which it was laid down.

5074 : 400 : : 20296 : 1600 the ſquare of the required ſcale.

$$\begin{array}{l} \quad\quad\ \text{Root.} \\ 1600(40 \\ 16 \\ \hline 8)00 \\ \hline \end{array}$$

Anſwer. The map was laid down by a ſcale of 40 perches to an inch.

P R O B. XVIII.

How to find the true content of a ſurvey, though it be taken by a chain that is too long or too ſhort.

Let the map be conſtructed, and its area found as if the chain were of the true length. And it will be

As the ſquare of the true chain
Is to the content of the map,
: : The ſquare of the chain you ſurveyed by
To the true content of the map.

E X A M P L E.

EXAMPLE.

If a ſurvey be taken with a chain which is 3 inches too long; or with one whoſe length is 42 feet 3 inches, and the map thereof be found to contain 920A. 2R. 20P. Required the true content.

As the ſquare of 42F. 0In. = the ſquare of 504 inches = 254016
Is to the content of the map 920A. 1R. 20P. = 147260P.
: : The ſquare of 42F. 3In. = the ſquare of 507 inches = 257049
To the true content.

	P.		P.
254016 :	147260 : :	257049 :	149019

A. R. P.
160)149019(931 . 1 . 19 anſwer.

501

219

40)59(1R.

19P.

SECT.

SECT. V.

Third Method for determining the Areas of right-lined Figures universally, or by Calculation.

CALCULATION.

DEFINITIONS.

Plate VIII. fig. 7.

1. MERIDIANS are north and ſouth lines, which are ſuppoſed to paſs through every ſtation of the ſurvey.

2. The difference of latitude, or the northing or ſouthing of any ſtationary line, is the diſtance that one end of the line is north or ſouth from the other end; or it is the diſtance which is intercepted on the meridian, between the beginning of the ſtationary line and a perpendicular drawn from the other end to that meridian. Thus, if N. S. be a meridian line paſſing through the point A of the line AB, then is *Ab* the difference of latitude, or ſouthing of that line.

3. The

3. The departure of any ſtationary line, is the neareſt diſtance from one end of the line to a meridian paſſing through the other end. Thus B*b* is the departure or eaſting of the line AB: but if CB be a meridian, and the meaſure of the ſtationary diſtance be taken from B to A; then is BC the difference of latitude, or northing, and AC the departure or weſting of the line BA.

4. That meridian which paſſes through the firſt ſtation, is ſometimes called the firſt meridian; and ſometimes it is a meridian paſſing on the eaſt or weſt ſide of the map, at the diſtance of the breadth thereof, from eaſt to weſt, ſet off from the firſt ſtation.

5. The meridian diſtance of any ſtation is the diſtance thereof from the firſt meridian, whether it be ſuppoſed to paſs through the firſt ſtation, or on the eaſt or weſt ſide of the map.

THEO. I.

In every ſurvey which is truly taken, the ſum of the northings will be equal to that of the ſouthings; and the ſum of the eaſtings equal to that of the weſtings.

Plate IX. fig. 1.

Let *a*, *b*, *c*, *e*, *f*, *g*, *h*, repreſent a plot, or parcel of land. Let *a* be the firſt ſtation, *b* the ſecond, *c* the third, &c. Let NS be a meridian line, then will all lines parallel thereto, which paſs through the ſeveral ſtations, be meridians alſo; as *ao*, *bs*, *cd*,

cd, &c. and the lines *bo*, *cs*, *de*, &c. perpendicular to thoſe, will be eaſt or weſt lines, or departures.

The northings $ei + go + hq = ao + bs + cd + fr$ the ſouthings: for let the figure be completed; then it is plain, that $go + hq + rk = ao + bs + cd$, and $ei - rk = fr$. If to the former part of this firſt equation $ei - rk$ be added, and *fr* to the latter, then $go + hq + ei = ao + bs + cd + fr$; that is, the ſum of the northings is equal to that of the ſouthings.

The eaſtings $cs + qa = ob + de + if + rg + ab$, the weſtings. For $aq + yo\ (az) = de + if + rg + ob$, and $bo = cs - yo$. If to the former part of this firſt equation, $cs - yo$ be added, and *bo* to the latter, then $cs + aq = ob + de + if + rg + ob$; that is, the ſum of the eaſtings is equal to that of the weſtings. Q. E. D.

SCHOLIUM.

This theorem is of uſe to prove whether the field-work be truly taken, or not: for if the ſum of the northings be equal to that of the ſouthings, and the ſum of the eaſtings to that of the weſtings, the field-work is right, otherwiſe not.

Since the proof and certainty of a ſurvey depend on this truth, it will be neceſſary to ſhew how the difference of latitude and departure for any ſtationary line, whoſe courſe and diſtance are given, may be obtained by the tables hereunto annexed.

To

To find the Difference of Latitude and Departure, by the Help of the annexed Table.

This table is ſo contrived, that by finding therein the given courſe, and a diſtance not exceeding 100 miles, chains, perches, or feet, the difference of latitude and departure is had by inſpection: the courſe is to be found at the top of the table when under 45 degrees; but at the bottom of the table when above 45 degrees. Each column ſigned with a courſe conſiſts of two parts, one for the difference of latitude, marked Lat. the other for the departure, marked Dep. which names are both at the top and bottom of theſe columns. The diſtance is to be found in the column marked Diſt. next the margin of the page.

E X A M P L E.

In the uſe of thoſe tables, a few obſervations only are neceſſary.

1. If a ſtation conſiſt of any number of even chains or perches (which are almoſt the only meaſures uſed in ſurveying) the latitude and departure are found at ſight under the bearing or courſe, if leſs than 45 degrees; or over it if more, and in a line with the diſtance.

2. If a ſtation conſiſt of any number of chains and perches, and decimals of a chain or perch, under the diſtance 10, the lat. and dep. will be found as above, either over or under the bearing;

 the

the decimal point or ſeparatrix being removed one figure to the left, which leaves a figure to the right to ſpare.

3. If the diſtance be any number of chains or perches, and the decimals of a chain or perch, the lat. and dep. muſt be taken out at two or more operations, by taking out the lat. and dep. for the chains or perches in the firſt place, and then for the decimal parts.

To ſave the repeated trouble of additions, a judicious ſurveyor will always limit his ſtations to whole chains, or perches and lengths, which can commonly be done at every ſtation, ſave the laſt.

1. In order to illuſtrate the foregoing obſervations, let us ſuppoſe a courſe or bearing, to be S. 35°. 15′ E. and the diſtance 79 four-pole chains. Under 35°. 15′, or $35\frac{1}{4}$ degrees, and oppoſite 79, we find 64. 52 for the latitude, and 45. 59 the departure, which ſignify that the end of that ſtation differs in latitude from the beginning 64. 52 chains, and in departure 45. 59 chains.

Note, We are to underſtand the ſame things if the diſtance is given in perches or any other meaſures, the method of proceeding being exactly the ſame in every caſe.

Again, let the bearing be $54\frac{3}{4}$ degrees, and diſtance as before; then over ſaid degrees we find the ſame numbers, only with this difference, that the lat. before found, will now be the dep. and the dep. the lat. becauſe $54\frac{3}{4}$ is the complement of

of $35\frac{1}{4}$ degrees to 90, *viz.* lat. 45. 59. dep. 64. 52.

2. Suppose the same course, but the distance 7 chains 90 links, or as many perches. Here we find the same numbers, but the decimal point must be removed one figure to the left.

Thus, under $35\frac{1}{4}$, and in a line with 79 or 7.9, are

Lat. 6. 45
Dep. 4. 56

the 5 in the dep. being increased by 1, because the 9 is rejected; but over $54\frac{3}{4}$ we get

Lat. 4. 56
Dep. 6. 45

3. Let the course be as before, but the distance 7. 79, then opposite

7. 70	Lat. 6. 29	Dep. 4. 43
9	7	6
7. 79	6. 36	4. 49

Or opposite

7. 00	Lat. 5. 72	Dep. 4. 03
. 79	. 64	. 46
7. 79	6. 36	4. 49

THEO.

THEO. II.

When the firſt meridian paſſes through the map.

If the eaſt meridian diſtances in the middle of each line be multiplied into the particular ſouthing, and the weſt meridian diſtances into the particular northing, the ſum of theſe products will be the area of the map.

Plate X. fig. 1.

Let the figure *abkm* be a map, the lines, *ab*, *bk* to the ſouthward, and *km*, *ma* to the northward, NS the firſt meridian line paſſing through the firſt ſtation *a*.

$$\left.\begin{array}{l}\text{The meridian}\\ \text{Diſtances eaſt}\end{array}\right\}\left.\begin{array}{l} zd \times ao \\ tu \times ox(by)\end{array}\right\} = \text{Area}\left\{\begin{array}{l} am\\ aw\end{array}\right.$$

$$\left.\begin{array}{l}\text{The meridian}\\ \text{Diſtances weſt}\end{array}\right\}\left.\begin{array}{l} ef \times gx \\ hb \times ga(my)\end{array}\right\} = \text{Area}\left\{\begin{array}{l} xp\\ gl\end{array}\right.$$

Theſe four areas $am + ow + xp + gl$ will be the area of the whole figure *cmſwiprlc*, which is equal to the area of the map *abkm*. Complete the figure.

The parallelograms *am* and *ow*, are made of the eaſt meridian diſtances *dz* and *tu*, multiplied into the ſouthings *ao* and *ox*. The parallelograms *xp* and *gl* are compoſed of the weſt meridian diſtances

tances *ef* and *hh*, multiplied into the northings *xg* and *ga* (*my*) but theſe four parallelograms are equal to the area of the map; for if from them be taken the four triangles marked Z, and in the place of thoſe be ſubſtituted the four triangles marked O, which are equal to the former; then it is plain the area of the map will be equal to the four parallelograms. Q. E. D.

THEO. III.

If the meridian diſtance when eaſt, be multiplied into the ſouthings, and the meridian diſtance when weſt be multiplied into the northings, the ſum of theſe leſs by the meridian diſtance when weſt, multiplied into the ſouthings, is the area of the ſurvey.

Plate X. fig. 2.

Let *a b c* be the map.

The figure being completed, the rectangle *af* is made of the meridian diſtance *eq* when eaſt, multiplied into the ſouthing *an*; the rectangle *yk* is made of the meridian diſtance *xw*, multiplied into the northing *cz* or *ya*. Theſe two rectangles, or parallelograms, *af* + *yk*, make the area of the figure *dfnyikd*, from which taking the rectangle *oy*, made of the meridian diſtance *tu* when weſt, into the ſouthing *oh* or *bm*, the remainder is the area of the figure *dfohikd*, which is equal to the area of the map.

Let

Let *bou* = Y, *urih* = L, *ric* = O, *wrc* = Z, *akw* = K, and *efb* = B, *ade* = A. I ſay, that Y + Z + B = K + L + A.

Y = L + O, add Z to both, then Y + Z = L + O + Z; but Z + O = K, put K inſtead of Z + O, then Y + Z = L + K, add to both ſides the equal triangles B and A, then Y + Z + B = L + K + A. If therefore B + Y + Z be taken from *abc*, and in lieu thereof we put L + K + A, we ſhall have the figure *dfohikd* = *abc*, but that figure is made up of the meridian diſtance when eaſt, multiplied into the ſouthing, and the meridian diſtance, when weſt, multiplied into the northing leſs by the meridian diſtance, when weſt, multiplied into the ſouthing. Q. E. D.

COROLLARY.

Since the meridian diſtance (when weſt) multiplied into the ſouthing, is to be ſubtracted, by the ſame reaſoning the meridian diſtance when eaſt, multiplied into the northing, muſt be alſo ſubtracted.

SCHOLIUM.

From the two preceding theorems we learn how to find the area of a map, when the firſt meridian paſſes through it; that is, when one part of the map lies on the eaſt and the other on the weſt ſide of that meridian. Thus,

RULE.

The merid. Diſt. when $\left.\begin{array}{l}\text{eaſt}\\ \text{weſt}\end{array}\right\}$ multiplied into the $\left\{\begin{array}{l}\text{ſouthings}\\ \text{northings}\end{array}\right\}$
their ſum is the area of the map.

But,

The merid. Diſt. when $\left\{\begin{array}{l}\text{eaſt}\\ \text{weſt}\end{array}\right\}$ multiplied into the $\left\{\begin{array}{l}\text{northings}\\ \text{ſouthings}\end{array}\right\}$
the ſum of theſe products taken from the former, gives the area of the map.

Theſe theorems are true, when the ſurveyor keeps the land he ſurveys, on his right hand, which we ſuppoſe thro' the whole to be done; but if he goes the contrary way, call the ſouthings northings, and the northings ſouthings, and the ſame rule will hold good.

General Rule for finding Meridian Diſtances.

1. The meridian diſtance and departure, both eaſt, or both weſt, their ſum is the meridian diſtance of the ſame name.

2. The meridian diſtance and departure of different names; that is, one eaſt and the other weſt, their difference is the meridian diſtance of the ſame name with the greater.

Thus

Thus in the firſt method of finding the area, as in the following field-book.

The firſt departure is put oppoſite to the northing or ſouthing of the firſt ſtation, and is the firſt meridian diſtance of the ſame name. Thus if the firſt departure be eaſt, the firſt meridian diſtance will be the ſame as the departure, and eaſt alſo; and if weſt, it will be the ſame way.

The firſt meridian diſtance	6.61 E.
The next departure	6.61 E.
The ſecond meridian diſtance	13.22 E.
The next departure	1.80 E.
The third meridian diſtance	15.02 E.

At ſtation 5, the meridian diſtance	5.78 E.
The next departure	7.76 W.
The next meridian diſtance	1.98 W.

At ſtation 11, the meridian diſtance	0.12 W.
The next departure	5.84 E.
The next meridian diſtance	5.72 E.

Plate X. fig. 3.

In the 5th and 11th ſtations, the meridian diſtances being leſs than the departures, and of a contrary name, the map will croſs the firſt meridian, and will paſs as in the 5th line, from the eaſt to the

the weſt ſide of the meridian; and in the 11th line it will again croſs from the eaſt to the weſt ſide, which will evidently appear, if the field-work be protracted, and the meridian line paſſing through the firſt ſtation, be drawn through the map.

The field-book caſt up by the firſt method, will be evident from the two foregoing theorems, and therefore requires no further explanation; but *to find the area, by the ſecond method*, take this

RULE.

When the meridian diſtances are eaſt, put the products of north and ſouth areas in their proper columns; but when weſt, in their contrary columns; that is, in the column of ſouth area, when the difference of latitude is north; and in north area when ſouth: the reaſon of which is plain, from the two laſt theorems. The difference of theſe two columns will be the area of the map.

No St.	Bearings.	C. L.	Lati. and half Dep.	Merid. Dist.	Area.	Deduct.
1	NE 75	13.70	N 3.54 E 6.61	6.61 E 13.22 E		23.3994
2	NE 20½	10.30	N 9.65 E 1.80	15.02 E 16.82 E		144.9430
3	East	16.20	0.00 E 8.10	24.92 E 33.02 E		
4	SW 33½	35.30	S 29.44 W 9.74	23.28 E 13.54 E	685.3632	
5	SW 76	16.00	S 3.87 W 7.76	5.78 E 1.98 W	22.3686	
6	North	9.00	N 9.00 0.00	1.98 W 1.98 W	17.8200	
7	SW 84	11.60	S 1.21 W 5.77	7.75 W 13.52 W		9.3775
8	NW 53¼	11.60	N 6.94 W 4.64	18.16 W 22.80 W	126.0304	
9	NE 36¾	19.20	N 15.38 E 5.74	17.06 W 11.32 W	262.3828	
10	NE 22½	14.00	N 12.93 E 2.68	8.64 W 5.96 W	111.7152	
11	SE 76¾	12.00	S 2.75 E 5.84	0.12 W 5.72 E		0.3300
12	SW 15	10.85	S 10.48 W 1.40	4.32 E 2 92 E	45.2736	
13	SW 16¾	10.12	S 9.69 W 1.46	1.46 E 0.00	14.1474	
					1285.1012 178 0499	178.0499
				Content in chains,	1107.0513	

The

It is needleſs here to inſert the columns of bearing or diſtances in chains, being the ſame as before.

No. St.	Lati. and half Dep	Merid. Dift.	N. Area.	S. Area.
1	N 3.54 E 6.61	6.61 E 13.22 E	23.3994	
2	N 9.65 E 1.80	15.02 E 16.82 E	144.9430	
3	0.00 E 8.10	24.92 E 33.02 E		
4	S. 29.44 W 9 74	23.28 E 13.54 E		685.3632
5	S 3.87 W 7.76	5.78 E 1 98W		22.3686
6	N 9.00 0.00	1.98W 1.98W		17.8200
7	S 1.21 W 5.77	7.75W 13.52W	9.3775	
8	N 6.94 W 4.64	18.16W 22.80W		126.0304
9	N 15.38 E 5.74	17.06W 11.32W		262.3828
10	N 12.93 E 2.68	8.64W 5.96W		111.7152
11	S 2.75 E 5.84	0.12W 5.72 E	0.3300	
12	S 10.48 W 1.40	4.32 E 2.92 E		45.2736
13	S 9.69 W 1.46	1.46 E 0.00		14.1474
			178.0499	1285.1012
				178.0499
	Area in chains, as before,			1107.0513

The Construction of the Map from either the 1st or 2d Table.

Plate X., fig. 3.

Draw the line NS. for a north and south line, which call the first meridian; in this line assume any point, as 1, for the first station. Set the northing of that stationary line, which is 3.54, from 1 to 2, on the said meridian line. Upon the point 2 raise a perpendicular to the eastward, the meridian distance being easterly, and upon it set 13.22, the second number in the column of meridian distance, from 2 to 2, and draw the line 1 2, for the first distance line: from 2 upon the first meridian, set the northing of the second stationary line, that is, 9.65 to 3, and on the point 3 erect a perpendicular eastward, upon which set the meridian distance of the second station 16.82, from 3 to 3, and draw the line 2 3, for the distance line of the second station. And since the third station has neither northing nor southing, set the meridian distance of it 33.02, from 3 to 4, for the distance line of the third station. To the fourth station there is 29.44, southing, which set from 3 to 5; upon the point 5 erect the perpendicular 5 5, on which lay 13.54, and draw the line 4 5.

In the like manner proceed to set the northings and southings on the first meridian, and the meridian distances upon the perpendiculars raised to the east or west; the extremities of which connected by right lines, will complete the map.

A Specimen of the Pennſylvania Method of CALCULATION; *which, for its Simplicity and Eaſe, in finding the Meridian Diſtances, is ſuppoſed to be preferable in Practice to any Thing heretofore publiſhed on the Subject.*

FIND in the firſt place, by the following tables, the lat. and dep. for the ſeveral courſes and diſtances, as already taught; and if the ſurvey be truly taken, the ſums of the northings and ſouthings will be equal, and alſo thoſe of the eaſtings and weſtings. Then in the next place, find the meridian diſtances, by chooſing ſuch a place in the column of eaſtings or weſtings, as will admit of a continual addition of the one, and ſubtraction of the other; by which means we avoid the inconvenience of changing the denomination of either of the departures.

The learner muſt not expect that in real practice the columns of lat. and thoſe of dep. will exactly balance when they are at firſt added up, for little inaccuracies will ariſe, both from the obſervations taken in the field, and in chaining; which to adjuſt, previous to finding the meridian diſtances, we may obſerve, That if, in ſmall ſurveys, the difference amount to two tenths of a perch for every ſtation, there muſt have been ſome error committed in the field; and the beſt way in this caſe, will be to rectify it on the ground by a re-ſurvey, or at leaſt as much as will diſcover the error. But when the differences are within

theſe

these limits, the work may be balanced in the following manner: on a slate, or separate piece of paper, find the lat. and dep. to each course and distance, as in the following example, observing to add an half of the differences to the numbers in the lesser column, and to subtract it from those of the greater, in such manner, as that the numbers may be altered nearly in proportion to their corresponding distances.

EXAMPLE.

Field-Notes.			From the Tables.				Balanced.			
No.	Courses.	Per.	N.	S.	E.	W.	N.	S.	E.	W.
1	S. 40 W.	70		53.6		45.0		53.6		45.0
2	N. 45 W.	89	62.9			62.9	63.0			62.9
3	N. 36 E.	125	101.1		73.5		101.2		73.5	
4	North.	54	54.0				54.0			
5	S. 81 E.	186		29.1	183.7			29.0	183.6	
6	S. 8 W.	137		135.7		19.1		135.6		19.2
7	West.	130				130.0				130.0
	A. R. P.		218.0	218.4	257.2	257.0	218.2	218.2	257.1	257.1
	207. 3.	22.69		218.0	257.0					
		Diff.		.4	.2					
		½ Diff.		.2	.1					

The latitudes and departures being thus balanced, proceed to insert the meridian distances by the above method, where we still make use of the same field-notes, only changing chains and links into perches and tenths of a perch. Then by looking along the column of departure, it is easy to observe, that in the columns of easting, opposite station 9, all the eastings may be added, and the westings subtracted without altering the denomination of either. Therefore by placing 46.0, the east departure belonging to this station in the column of meridian distances, and proceeding to add the eastings and subtract the westings, according to the rule already mentioned, we shall find that at station 8, these distances will end in 0, 0, or a cypher, if the additions and subtractions be rightly made. Then multiplying the upper meridian distance of each station by its respective northing or southing, the product will give the north or south area, as in the examples already insisted on, and which is fully exemplified in the annexed specimen. When these products are all made out, and placed in their respective columns, their difference will give double the area of the plot, or twice the number of acres contained in the survey. Divide this remainder by 2, and the quotient thence arising by 160 (the number of perches in an acre) then will this last quotient exhibit the number of acres and perches contained in the whole survey; which, in this example, may be called 110 acres, 103 perches, or 110 acres, 2 quarters, 23 perches.

FIELD-

FIELD-NOTES *of the two foregoing Methods, as practiſed in Pennſylvania.*

Caſt up by perches and tenths of a perch.

N.	Courſes.	Diſt.	N.	S.	E.	W.	M. D.	N. Area.	S. Area.
1	N 75.00 E	54.8	14.2		52.9		235.3 288.2	3341.26	
2	N 20.30 E	41.2	38.6		14.4		302.6 317.0	11680.36	
3	Eaſt.	64.8			64.8		381.8 446.6		
4	S 33.30 W	141.2		117.7		77.9	368.7 290.8		43395.99
5	S 76.00 W	64.0		15.5		62.1	228.7 166.6		3544.85
6	North.	36.0	36.0				166.6 166.6	5997.60	
7	S 84.00 W	46.4		4.9		46.1	120.5 74.4		590.45
8	N 53.15 W	46.4	27.8			37.2	37.2 00.0	1034.16	
9	N 36.45 E	76.8	61.5		46.0		46.0 92.0	2829.00	
10	N 22.30 E	56.0	51.7		21.4		113.4 134.8	5862.78	
11	S 76.45 E	48.0		11.0	46.7		181.5 228.2		1996.50
12	S 15.00 W	43.4		41.6		11.2	217.0 205.8		9092.30
13	S 16.45 W	40.5		38.8		11.7	194.1 182.4		7531.08
			220.8	229.8	246.2	246.2		30745.16	66151.17 30745.16
								2	35406.01

Area in perches, 17703.005

SECT. VI.

Containing the Nature of Off-ſets and Interſections; the Methods of enlarging, or diminiſhing, and connecting Maps; the Variation of the Compaſs and its Uſes in Surveying; the whole concluding with ſome neceſſary Directions concerning Surveys in general.

OF OFF-SETS.

IN taking ſurveys it is unneceſſary and unuſual to make a ſtation at every angular point, becauſe the field-work can be taken with much greater expedition, by uſing off-ſets and interſections, and with equal certainty; eſpecially where creeks, &c. bound the ſurvey.

Off-ſets are perpendicular lines drawn or meaſured from the angular points of the land, that lie on the right or left hand to the ſtationary diſtance, thus,

Plate XI. fig. 2.

Let the black lines repreſent the boundaries of a farm or townſhip: and let 1 be the firſt ſta-

tion,

tion, then if you have a good view to 2, omit the angular points between 1 and 2, and take the bearing and length of the ſtationary line 1, 2, and inſert them in your field-book: but in chaining from 1 to 2, ſtop at *d* oppoſite to the angular point *a*, and in your field-book inſert the diſtance from 1 to *d*, which admit to be 4C. 25L. as well as the meaſure of the off-ſet *ad*, which admit to be 1C. 12L. thus; by the ſide of your field-book in a line with the firſt ſtation, ſay at 4C. 25L. L. 1C. 12L. that is, at 4C. 25L. there is an off-ſet to the left hand of 1C. 12L.

This done, proceed on your diſtance line to *e*, oppoſite to the angle *b*, and meaſure *eb*, ſuppoſing then 1 *e* to be 7C. 40L. and *eb* 3C. 40L. ſay (ſtill in a line with the firſt ſtation in your field-book) "at 7C. 40L. L. 3C. 40L." that is, at 7C. 40L. there is an off-ſet to the left of 3C. 40L. proceed then with your diſtance line to *f*, oppoſite to the angle *c*, and meaſure *fc*; ſuppoſe then 1 *f* to be 13C. and *fc* 1C. 25L. ſay in the ſame line as before, at 13C. L. 1C. 25L. Then proceed from *f* to 2, and you will have the meaſure of the entire ſtationary line 1, 2, which inſert in its proper column by the bearing.

In taking off-ſets, it is neceſſary to have a perch chain, or a ſtaff of half a perch, divided into links for meaſuring them; for by theſe means the chain in the ſtationary line is undiſturbed, and the number of chains and links in that line from whence, or to which, the off-ſets are taken, may be readily known.

Having arrived at the ſecond ſtation, if you find your view will carry you to 3, take the bearing from 2 to 3, and in meaſuring the diſtance line, ſtop

ſtop at *l* oppoſite *g*; admit 2*l* to be 4C. 10L. and the off-ſet *lg* 1C. 20L. then in a line with the ſecond ſtation in your field-book, ſay at 4C. 10L. R. 1C. 20L. that is, the off-ſet is a right-hand one of 1C. 20L. Again at *m*, which ſuppoſe to be 10C. 25L. from 2; take the off-ſet *mh* of 1C. 15L. and in a line with the ſecond ſtation, ſay at 10C. 25L. R. 1C. 15L. In the ſame line when you come to the boundary at *i*, inſert the diſtance 2*i*, 13C. 10L. thus, at 13C. 10L.0; that is, at 13C. 10L. there is no off-ſet. At *n*, which is 15C. from 2, take the off-ſet *nk* 45L. and ſtill oppoſite to the ſecond ſtation ſay at 15C. L. 45L.

Let the line 3, 6, repreſent the boundary, which by means of water, briers, or any other impediment cannot be meaſured. In this caſe make one or more ſtations within or without the land, where the diſtances may be meaſured, and draw a line from the beginning of the firſt to the end of the laſt diſtance, thus; make ſtations at 3, 4, and 5, taking the bearings, and meaſuring the diſtances as uſual, which inſert in your field-book, and draw a mark like one ſide of a parentheſis, from the third to the fifth ſtation, to ſhew that a line drawn from the third ſtation to the furtheſt end of the fifth ſtationary line will expreſs the boundary. Thus,

No. Sta.	Deg.	Ch. L.
(3	$172\frac{1}{2}$	5·45
(4	200	13·25
(5	250	3·36

Suppoſe the point *p* of the boundary to be inacceſſible, by means of the lines 6*p* or *p*7, being overflowed, or that of a quarry, furze, &c. might prevent you taking their lengths: in this caſe take the bearing of the line 6, 7, which inſert oppoſite

pofite to the fixth ftation in your field-book with the other bearings; then direct the index to the point p, and infert its bearing on the left fide of the field-book, oppofite to the fixth ftation, annexing thereto the words, *Int. for boundary;* and having meafured and inferted the diftance 6, 7, fet the index in the direction of the line $7p$, and infert its bearing on the left of the feventh ftation of the field-book, annexing thereto the words *Int. for boundary;* the croffing or interfection of thefe two bearings will determine the point p, and of courfe the boundary $6p7$ is alfo determined.

If your view will then reach to the firft ftation, take its bearing, ftationary line, and off-fets, as before, and you have the field-book completed. Thus,

The FIELD-BOOK.

Remarks and Interfect.	No St.	Deg.	C. L.	OFF-SETS.
318 Int. to a tower	1	358	22.12	*At* 4*C.* 25*L. L.* 1*C.* 12*L. at* 7*C.* 40*L. L.* 3*C.* 40*L. at* 13*C. L.* 1*C.* 25*L.*
231½ Int. to ditto	2	297¾	21.12	*At* 4*C.* 10*L. R.* 1*C.* 20*L. at* 10*C.* 25*L. R.* 1*C.* 15*L. at* 13*C.* 10*L.* o. *at* 15*C. L.* 45*L.*
	3	172¼	5.45	
	4	200	13.25	
	5	250	3.36	
155½ Int. for boun.	6	125	15.15	*At* 1*C.* 20*L. L.* 2*C.* 20*L.* : *at* 7*C.* 45*L. L.* 2*C.* 32*L. at* 11*C.* 25*L.* o. *at* 12*C.* 25*L. R.* 36*L.*
274 Int. for ditto	7	105¼	15.10	

Clofe at the firft ftation.

If you would lay down a tower, houfe, or any other remarkable object in its proper place; from any

any two ſtations take bearings to the object, and their interſection will determine the place where you are to inſert it, in the manner that the tower is ſet out in the figure, from the interſections taken at the firſt and ſecond ſtations of the above field-book.

A protraction of this will render all plain, on which lay off your off-ſets and interſections, and proceed to find the content by any of the methods in ſection the 4th.

The foregoing field-book may be otherwiſe kept, thus,

Remarks and Interſection.	No St.	Deg.	L. han. Off-ſet. Ch. L.	Diſt. Ch. L.	R. han. Off-ſet. Ch. L.
318 Int. to a tower	1	358	1.12	4.25	
			3.40	7.40	
			1.25	13.00	
				22.12	
231½ Int. for ditto	2	297¾		4.10	1.20
				10.25	1.15
				13.10	
			0.45	15.00	
				21.12	
	3	172½		5.45	
	4	200		13.25	
	5	250		3.36	
155½ Int. for bound.	6	125		15.15	
274 In. for boundary	7	105	2.20	1.20	
			2.32	7.45	
				11.25	
				12.25	0.36
				15.10	

Cloſe at the firſt ſtation.

How

How to cast up off-sets by the pen.

Plate XI. fig. 2.

$1, 2 - 1f = 2f$, $1f - 1e = fe$, $1e - 1d = ed$.

Then $1d \times \frac{1}{2}da = 1da$, by prob. 6. page 183, and $\frac{1}{2}ed \times da + eb = adeb$ by the doctrine of trapezia; also $\frac{1}{2}fe \times eb + fc = befc$, and $2f \times \frac{1}{2}fc = cf2$; the sum of all which will be $1abc21$; the area contained between the stationary line 1, 2, and the boundary, 1 *abc* 2.

In the same manner you may find the area of *2ihg2* of *ik3i*, as well as what is without and within-inside of the stationary line 7, 1.

If therefore the left hand off-sets exceed the right hand ones, it is plain, the excess must be added to the area within the stationary lines, but if the right hand off-sets exceed the left hand ones, the difference must be deducted from the said area; if the ground be kept on the right hand as we have all along supposed; or in words thus;

To find the contents of off-sets.

1. From the distance line, take the distance to the preceding off-set, and from that the distance of the one preceding it, &c. in four-pole chains; so will you have the respective distances from off-set to off-set, but in a retrograde order.

2. Multiply the last of these remainders by $\frac{1}{2}$ the first off-set, the next by $\frac{1}{2}$ the sum of the first

first and second, the next by half the sum of the second and third, the next by half the sum of the third and fourth, &c.. The sum of these will be the area produced by the off-sets.

Thus, in the foregoing field-book, the first stationary line is 22C. 12L. or 11C. 12L. of four-pole chains. See the figure.

	Ch. L.	Ch. L.	Ch. L.
From	11.12 = 1,2	6.50 = 1*f*	3.90 = 1*e*
Take	6.50 = 1*f*	3.90 = 1*e*	2.25 = 1*d*
	4.62 = 2*f*	2.60 = *ef*	1.65 = *ed*

Ch. L.	
1*d* = 2.25 × 32L. half the first off-set =	.7200
ed = 1.65 × 1C. 26L. ½ the sum of the 1st & 2d	2.0790
ef = 2.60 × 1C. 32L. ½ the sum of 2d & 3d =	3.4320
2*f* = 4.62 × 37L. half the last off-set =	1.7094
Content of left off-sets on the first dist. in square four-pole chains	7.9404

In like manner the rest are performed.

The sum of the left hand off-sets will be	14.0856
And the sum of the right hand ones	3.6825
Excess of left hand off-sets in squ. 4 pole C.	10.4031
Acres	1.04031
	,16124
	4
Perches	6.4496

Excess of left hand off-sets above the right hand ones, 1A. 0R. 6P. to be added to the area within the stationary lines.

OF INTERSECTIONS.

How to find the Area of a Piece of Ground by Intersections only, when all the Angles of the Field can be seen from any two Stations on the Outside of the Ground.

Plate XII. fig. 1.

LET ABCDEFGA be a field, H and I two places on the outside of it, from whence an object at every angle of the field may be seen.

Take the bearing and distance between H and I, and set that at the head of your field-book, as in the annexed one. Fix your instrument at H, from whence take the bearings of the several angular points, A, B, C, D, *&c.* as they are here represented by the lines HA, HB, HC, HD, *&c.* Again fix your instrument at I, and take bearings to the same angular points, represented by the lines IA, IB, IC, ID, *&c.* and let the first bearings be entered in the second column, and the second bearings in the third column of your field-book: then it is plain that the points of intersection, made from the bearings in the second and third columns of every line, will be the angular points of the field or the points A, B, C, D, *&c.* which points being joined by right lines, will give the plan ABCDEFGA required.

Bea.

Bea. 180 Dif. 28C. of the Sta. H. and I.		
No.	Bear.	Bear.
A	261½	331½
B	265¾	317¼
C	248	307½
D	238¼	289
E	215½	262½
F	208½	286½
G	220	300

The ſame may be done from any two ſtations within-ſide of the land, from whence all the angles of the field can be ſeen.

This method will be found uſeful in caſe the ſtationary diſtances from any cauſe prove inacceſſible, or ſhould it be required to be done by one party, when the other in whoſe poſſeſſion it is, refuſes to admit you to go on the land.

To find the content of a field by calculation, which was taken by interſection.

In the triangle AIH, the angles AHI, AIH, and the baſe HI being known, the perpendicular A*a*, and the ſegments of the baſe H*a*, *AI* may be obtained by trigonometry: and in the ſame manner all the other perpendiculars B*b*, C*c*, D*d*, E*e*, F*f*, Gg, and the ſeveral ſegments at *b*, *c*, *d*, *e*, *f*, and *g*: if therefore the ſeveral perpendiculars be ſuppoſed to be drawn in the ſcheme (which are here omitted to prevent confuſion ariſing from a multiplicity of lines) it is plain that if from

H h *b*BCDE*eb*,

*b*BCDE*eb*, there be taken *b*BAGF*eb*, the remainder will be the map ABCDEFGA.

As before, half the fum of B*b*, and C*c*, multiplied by *bc*, will be the area of the trapezium *b*BC*c*; after the fame manner, half the fum of C*c*, and D*d*, multiplied by *cd*, will give the area of the trapezium *c*CD*d*; and again, half the fum of D*d*, and E*e* multiplied by *de*, gives the area of the trapezium *d*DE*e*; and the fum of thefe three trapezia will be the area of the figure *b*BCD*eb*.

Again, in the fame manner, half the fum of B*b*, and *aA* multiplied by *ab*, will give the area of the trapezium *b*BA*a*; and half the fum of *a*A, and gG, by *ag*, gives the trapezium *a*AG*g*; to thefe add the trapezia *g*GF*f*, and *f*FE*e*, which are found in the like manner, and you will have the figure *b*BAGFE*eb*, and this taken from *b*BCD*eb*, will leave the map ABCDEFGA. Q. E. F.

It will be fufficient to protract this kind of work, and from the map to determine the area, as well as in plate X. fig. 3. to find the areas of the pieces 3, 4, 5, 6, 3, and 6, 7, 7, 6, from geometrical conftructions.

How to determine the ftation where a fault has been committed in a field-book, without the trouble of going round the whole ground a fecond time.

From every fourth or fifth ftation, if they be not very long ones, or oftner if they are, let an interfection be taken to any object, as to any particular part

part of a caſtle, houſe, or cock of hay, &c. or if all theſe be wanting, to a long ſtaff with a white ſheet or napkin ſet thereon to render the object more conſpicuous, and let this be placed on the ſummit of the land, and let the reſpective interſections ſo taken be inſerted on the left hand ſide of the field-book, oppoſite to the ſtations from whence they were reſpectively taken.

In your protraction as you proceed, let every interſection be laid off from the reſpective ſtations from whence they were taken, and let theſe lines be continued; if they all converge or meet in one point, we thence conclude all is right, or ſo far as they do converge; but if we find a line of interſection to diverge or fly off from the reſt, we may be ſure that either a miſtake has happened between the ſtation the foregoing interſection was taken at, and the ſtation from whence the interſection line diverges, or there muſt be an error in the interſection; but to be aſſured in which of theſe the fault is, protract on to the next interſection, and having ſet it off, if it converges with the reſt, tho' the foregoing one did not, we may conclude the fault was committed in taking the laſt interſection but one, and none in any ſtation, and that ſo far is true as is protracted; but if this as well as the foregoing interſection diverge, or fly from the point of concourſe or converging point of the reſt, the error muſt have its riſe from ſome ſtation or ſtations, at or after that, from whence the laſt converging interſection line was taken; ſo that by going to that ſtation on the ground and proceeding on to that where the next, or from whence the following diverging interſection was taken, we can readily and with little trouble ſet all to rights.

But

But in moſt tracts of land, one object cannot be ſeen from every ſtation, or from perhaps one fourth of them; in this caſe we are under the neceſſity to move the pole after we begin to loſe ſight of it, to ſome other part of the land, where it may be ſeen from as many more ſtations as poſſible; which is eaſily done by viewing the boundary before it be ſurveyed: the pole then being fixed in an advantageous place, the firſt interſection to it is beſt to be made from the ſame ſtation from whence the laſt one was taken, and then as often as may be thought convenient, as before: in like manner the whole may be done by the removal of the pole.

When we here ſpeak of ſtations, we do not mean ſuch as are uſually taken at every particular angle of the field: for it is to be apprehended, that every ſkilful ſurveyor, particularly ſuch who uſe calculation, will take the longeſt diſtances poſſible, not only to leſſen the number of ſtations, for the eaſe of either protraction or calculation, but with greater certainty to account for the land paſſed by, on the right hand or on the left, which is taken by off-ſets: and ſurely it will be allowed that any meaſure taken on the ground and the content thence arithmetically computed, will be much more accurate than that which is obtained from any geometrical projection.

From what has been ſaid it is plain, that from this method any fault committed in a ſurvey can be readily determined, and therefore muſt be much preferable to the preſent method of taking diagonals, or the bearings and lengths of lines acroſs land, to accompliſh that end; which laſt method is too frequently uſed by ſurveyors to approximate

or

or arrive near the content, which will ever remain uncertain, let these diagonals be ever so many, till the station or stations wherein the error or errors were committed, be found; and the fault or faults be corrected.

Where one diagonal is taken, it may perhaps close or meet with one part of the survey and not with the other; in this case, if the surveyor would discover his error, he must survey that part of the land which did not close, and this may be half or more, of the whole. And should the diagonal close with neither part, but be too long, or too short, or should it fall on either side of the assigned point it was to close with, he ought to go over the whole, and make a new survey of it in order to discover his error.

A number of diagonals are frequently taken, the sum of the lengths of which very often exceeds the circuit of the ground, and after all they are but approximations, and the content remains uncertain as before; therefore he who returns a map, made up by the assistance of diagonals, where there remains a misclosure in any one part, runs the risque of being detected in an error, and must suffer uneasiness in his mind, as he cannot be certain of the return he makes.

The frequent misclosures which are botched up by diagonals, occasion the many and frequent scandalous broils and animosities between surveyors, which tend to the loss of character of the one or the other, and indeed often to the disrepute of both, as well as to that of the science they profess.

But these may be easily remedied by intersections, and the bearing or line be adjusted where the fault was committed, and till this be found, nothing can be certain.

To

To enlarge or diminiſh MAPS.

How to enlarge or diminiſh a Map, or how to reduce a Map from one Scale to another: alſo the Manner of uniting ſeparate Maps of Lands which join each other, into one Map of any aſſigned Size.

LAY the map you would enlarge, over the paper on which you would enlarge it, and with a fine protracting pin, prick thro' every angular point of your map, join theſe points on your paper (laying the map you copy before you) by pencilled or popped lines, and you have the copy of the map you are to enlarge: in this manner any protraction may be copied on paper, vellum, or parchment for a fair map.

If you would enlarge a map to a ſcale which is double, or treble, or quadruple to that of the map to be enlarged, the paper you muſt provide for its enlargement muſt be two, or three, or four times as long and broad as the map; for which purpoſe in large things you will find it neceſſary to join ſeveral ſheets of paper, and to cement them with white wafer or paſte, but the former is beſt.

Then pitch upon any point in your copied map, for a center; from whence if diſtances be taken to its extreme points, and thence if thoſe diſtances be ſet in a right line with (but from) the center, and theſe

these last points fall within your paper, the map may be increased on it to a scale as large again as its own; and if the like distances be again set outwards in right lines from the center, and if these last points fall within your paper, it will contain a map increased to a scale three times as large as its own, &c.

Plate XII. fig. 2.

Let the pricked or popped lines represent the copy of a down or old survey, laid down by a scale of 80 perches to an inch, and let it be required to enlarge it to one laid down by 40 to an inch.

Pitch upon your center as ⊙, from whence thro' *a* lay the fiducial edge of a thin ruler, with a fine pointed pair of compasses, take the distance from *a* to the center ⊙, and lay it by the ruler's edge from *a* to A: in the like manner take the distance from the next station *b* to the center ⊙, and lay it over in a right line from *b* to B, and join the points A and B by the right line AB: in the like manner set over the distance from every station to the center, from that station outwards, and you will have every point to enlarge to; the joining of these constantly as you go on by right lines, will give you the enlarged map required.

In taking the distances from every station to the center, set one foot of the compasses in the station, and the other very lightly over the center-point, so lightly as scarcely to touch it, otherwise the center-point will become so wide, that it may occasion several errors in the enlarged map: for if you err from the exact center but a little, that error will become double, or treble, or quadruple,

druple, as you enlarge to a ſcale that is double, or treble, or quadruple, of the given one; therefore great accuracy is required in enlarging a map.

When you have done with a ſtation, give a daſh with a pen or pencil to it, ſuch as at the ſtation *a* and *b*; by this means you cannot be diſappointed in miſſing a ſtation, or in laying your ruler over one ſtation twice.

From what has been ſaid it is plain, that if a map is to be enlarged to one whoſe ſcale is double the given one, that the diſtances from the reſpective ſtations to the center, being ſet over by the ruler's edge, will give the points for the enlarged one. And thus may a map be enlarged from a ſcale of 160 to one of 80, from one of 80 to one of 40, from one of 20 to one of 10 perches to an inch, &c. For to enlarge to a ſcale that is double, the number of perches to an inch for the enlarged map, muſt be half of thoſe to an inch for that to be enlarged: to enlarge to a ſcale that is treble the given one, the number of perches to an inch for the enlarged map, will be one third of thoſe for the other; if to a ſcale that is quadruple the given one, the number of perches to an inch for the enlarged map, will be one fourth of thoſe for the other, &c. therefore if you would enlarge a map which is laid down by a ſcale of 120 perches to an inch, to one of 40 perches to an inch, the diſtance from the ſeveral ſtations to the center, being ſet twice beyond the ſaid ſtations, will mark out the ſeveral points required, for theſe points will be three times further from the center than the ſtationary points of the map are.

In the ſame manner, if you would enlarge a map from a ſcale of 160, to one of 40 perches to an inch, the diſtance from the ſeveral ſtations

to

to the center, being ſet three times beyond ſaid ſtations, will lay out the points for your enlarged map, for theſe points will be four times further from the center than are the ſtations of the map.

When a map is enlarged to another, whoſe ſcale is double, or treble, or quadruple, &c. of the given one, every line, as well as the length and breadth of the enlarged map, will be double, or treble, or quadruple, &c. thoſe of the given one, for it muſt be eaſy to conceive that thoſe maps are like: but the area, if the ſcale be double, will be four times; if treble, nine times; if quadruple, ſixteen times that of the given figure; that is, it will contain four, nine, or ſixteen times as many ſquare inches as the given one (for it has been ſhewn that like polygons are in a duplicate proportion with the homologous ſides.) Yet theſe figures being caſt up by their reſpective ſcales, will produce the ſame content.

Thus much is ſufficient for enlarging maps, and from hence, diminiſhing of them will be obvious; for one fourth, one third, or half the diſtances from the ſeveral ſtations to the center, will mark out points, which, if joined, will compoſe a map ſimilar to the given one, whoſe ſcale will be four times, three times, or twice as ſmall as the given one.

Thus, if we would reduce a map from 40 to 80, from 20 to 40, from 10 to 20 perches to an inch, &c. half the diſtance of the ſtations from the center will give the points requiſite for drawing the map; if we would reduce from 40 to 120, from 20 to 60, from 10 to 30 perches to an inch, &c. one third of the diſtances to the center, will give the points for the map: and if we would reduce

 from

from 40 to 160, from 20 to 80, from 10 to 40 perches to an inch, &c. one fourth of the diſtances to the center, will give the points for the map.

By the methods here laid down I have reduced a map from a ſcale of 40 to one of 20 perches to an inch, which contained upwards of 1200 acres, and conſiſted of 224 ſeparate diviſions, without the leaſt confuſion from the lines; for none can ariſe if the methods here laid down be ſtrictly obſerved.

I have alſo from the ſame methods reduced a large book of maps, each of which was an entire ſkin of parchment, and the whole contained upwards of 46000 acres, to a pocket volume; and afterwards connected all theſe maps into one map, which was contained in one ſkin of parchment: therefore upon the whole I do recommend theſe methods for reducing maps to be much more accurate than any of the methods commonly uſed, ſuch as ſquaring of paper, uſing a parallelogram, proportional compaſſes, or any other method I ever met with, though the figures to be reduced were ever ſo numerous, irregular, or complicated.

How to unite ſeparate maps of lands which join each other, into one map of any aſſigned ſize.

If there be ſeveral large maps contained in a book, each of which ſuppoſe to take up a ſkin of parchment, or a ſheet of the largeſt paper; which maps of lands join each other; and it be required to reduce them to ſo ſmall a ſcale, that all of them when joined together may be contained in

in one ſkin, half a ſkin, or any aſſigned ſized piece of parchment, or paper.

Having pricked off and copied the ſeveral maps on any kind of paper, unite them by cutting with ſciſſars along the edge of one boundary which is adjoining the other, but not cutting by the edge of both, and throw aſide the parts cut off; then lay theſe together on a large table, or on the floor, and where the boundaries agree, they will fit in with each other as indentures do; and after this manner they are eaſily connected: meaſure then the length and breadth of the entire connected maps, and the length and breadth of the parchment or paper you are confined to; if the former be three, four, or five times greater (that is, longer and broader) than the latter, reduce each copied map ſeverally to a ſcale that is three, or four, or five times leſs, as before; and the ſame parts of the boundaries you cut by in the large maps, by the ſame you muſt alſo cut in ſmall ones, and unite the ſmall as the large ones were united; cementing them together with white wafer: thus will your map be reduced to the aſſigned ſize, which copy over fair, on the parchment, or paper you were confined to.

But it is not always that a perſon is confined to a given area of parchment, or paper; in ſuch caſes, if there are many large maps to be united into one, reduce each of them ſeverally to a ſcale of 160 perches to an inch, and unite thoſe by the contiguity or boundaries, as before: or if you have a few, it will be ſufficient to reduce them to a ſcale of 120, &c. But having the maps given, and the ſcale by which they are laid down, your reaſon will be ſufficient to direct you to know, what ſcale they ſhould be reduced to.

THE

THE

VARIATION of the COMPASS;

And how to find it by Amplitudes or Azimuths of the Sun.

1. IT was before obſerved, that the needle does not point truly to the north or ſouth points of the horizon: the number of degrees therefore, that the points of the needle are from the north or ſouth points of the horizon, is called the *variation of the needle*, or *compaſs*.

This variation differs widely in many places; for in ſome, the needle will point ſeveral degrees on the weſt ſide of the north; at others there will be little or no variation, and again, at others it will point ſeveral degrees on the eaſt ſide; in the ſame place it differs ſenſibly in a few years: the true cauſe or theory of which, has not hitherto been diſcovered or explained for want of a ſufficient number of obſervations.

2. The globe of the earth revolves round its axis in twenty four hours from weſt to eaſt, and hence all celeſtial bodies ſeem to move from eaſt to weſt.

3. The extremities of the axis are called the *poles*; the one the north or *arctic*, and the other the ſouth or *antarctic*. And if the axis be produced to the heavens, it will point out the *celeſtial poles*.

4. If

4. If a circle be ſuppoſed to paſs round the globe of the earth, ſo as to be equidiſtant from each pole, it is called the *equator*, or *equinoctial line*, and by ſome the *line* only.

And if the plane of the equator be produced to the heavens, it will lay out the *celeſtial equator*.

5. *The latitude of any place*, is its neareſt diſtance to, and counted from the equator in degrees and minutes; and is north or ſouth as it lies on the north or ſouth ſide of the equator.

6. The poles are 90 degrees from the equator; therefore the *complement of the latitude of any place*, is the latitude taken from 90 degrees, or the diſtance of the place from its neareſt pole.

7. *The declination of the ſun*, is the neareſt diſtance thereof from the celeſtial equator counted in degrees and minutes; and is north or ſouth, as it lies on the north or ſouth ſide of the equator.

8. The ſun's declination taken from 90, leaves the *complement* thereof; or its diſtance from the neareſt celeſtial pole.

9. *The ſun's altitude*, is the number of degrees and minutes the ſun is above the horizon, and is eaſily found by a quadrant, as before.

10. What the ſun's altitude wants of 90, or the ſun's diſtance from the *zenith* or point of the heavens perpendicularly over you, is the *complement of the altitude*.

11. *The magnetical amplitude*, is the complement of the ſun's bearing at riſing or ſetting, taken by the quarter'd compaſs; on it is the number of degrees the ſun is from the eaſt or weſt point of the compaſs, at riſing or ſetting.

12. *The true amplitude*, is the complement of degrees the ſun would riſe or ſet on if the compaſs did not vary; or it is the number of degrees the ſun is from the eaſt or weſt point of the horizon, at riſing or ſetting; and this true amplitude is always north, if the ſun's declination be north; or ſouth if the ſun's declination be ſouth.

To find the variation by the amplitudes.

Having the latitude of the place, and the ſun's declination given, the true amplitude is found by this aſtronomical proportion, *viz.*

As the co-ſine or ſine complement of the latitude,
Is to the ſine of the ſun's declination,
So is radius
To the ſine of the true amplitude.

Then if both amplitudes be north, or both ſouth, their difference is the variation, but if one be north and the other ſouth, their ſum is the variation.

To know whether the variation be eaſterly or weſterly.

Let the obſerver turn his face to the ſun, then if the true amplitude be to the right hand of the magne-

magnetical one, the variation is easterly, but if to to the left, westerly.

EXAMPLE I.

On the 28th day of May, 1789, the sun's bearing at rising, being N. 71° E. in the latitude 53°. 20 N. required the true amplitude, and the variation of the needle.

Find the sun's declination, by the annexed table, and then to find the true amplitude, say,

As the co-sine of the latitude	36°. 40′	9.77609
Is to the sine of the declination	21°. 34′ N.	9.56536
So is radius	90°.	10.00000
To the sine of the true amplitude	38°	9.78927

90°—71° = 19° the mag. amp. from the east.

True amplitude E. 38°.00′ N. for the decl. is N.
Magnetical ampl. E. 19°.00 N.

Variation 19°.00 W. because the true amplitude is to the left of the magnetical.

EXAM-

EXAMPLE II.

Suppose the sun's true amplitude is found to be W. 42°.00 S. and the magnetical amplitude W. 23. 00 S. the sun's bearing at setting being SW. 67°. Required the variation.

$90° - 67° = 23°$ the magnetical amplitude from the west.

True amplitude	W.	42°	00′	S.
Magnetical amplitude	W.	23	.00	S.
Variation		19	.00	W.

In this case also the true amplitude is to the left of the magnetical; and therefore the variation is westerly.

EXAMPLE III.

Sun's bearing at rising being SE. 77°½, and the true amplitude being found to be E. 10°. 12 N. required the variation.

$90° - 77°\frac{1}{2} = 12°\frac{1}{2}$ the magnetical amplitude from the east.

True amplitude	E.	10°.	12′	N.
Magnetical amplitude	S.	12	.30	S.
Variation		22	.42	W.

The true amplitude being still to the left, the variation is westerly.

EXAM-

EXAMPLE IV.

Sun's bearing at ſetting is SW. $81^\circ\frac{1}{2}$, and the true amplitude is found to be W. 6°. 16′ N. Required the variation.

$90^\circ - 81^\circ\frac{1}{2} = 8^\circ\frac{1}{2}$ the magnetical amplitude from the weſt.

True amplitude	W.	6°.	16′	N.
Magnetical amplitude	W.	8	.30	S.
Variation		14	.46	E.

The true amplitude being to the right of the magnetical, the variation is eaſterly.

2. *To find the variation by azimuths.*

13. The ſun's magnetical azimuth is the bearing thereof at any time of the day, taken by the quartered compaſs; that is, counted from the north or ſouth towards the eaſt or weſt points of the box.

14. The ſun's true azimuth is the point of the compaſs it would bear from you upon, if there were no variation; or it is the diſtance intercepted between the north or ſouth points of the horizon, and a vertical circle, or circle drawn from the zenith through the ſun to the horizon.

Having the latitude of the place, the ſun's declination, and its altitude given, the true azimuth is obtained by the following aſtronomical proportions.

1. As the tangent of half the complement of the latitude,

Is to the tangent of half the fum of the diftance of the fun from the pole, and complement of the altitude,

So is the tangent of half the difference between the diftance of the fun from the pole, and complement of the altitude,
To the tangent of a fourth arc.

Add this fourth arc and half the complement of the latitude together, their fum will give a fifth arc; from which if the complement of the latitude be taken, the remainder will give a fixth arc. Then fay,

As radius
Is to the tangent of the altitude,
So is the tangent of the fixth arc
To the co-fine of the fun's true azimuth.

Which is counted from the north or fouth, to the eaft or weft, according to the fun's fituation at the time and place of obfervation.

If the latitude of the place, and the fun's declination be both north or both fouth, the declination taken from 90°, gives the fun's diftance from the pole; but if one be north and the other fouth, the declination added to 90°, will give the fun's diftance from that pole which is neareft the obferver.

If both azimuths are eaft or weft, their difference is the variation; but if one be eaft, and the other weft, their fum is the variation.

To know whether the variation be eafterly or wefterly.

Juft as with the amplitudes, let the obferver's face be turned to the fun; then if the true azimuth be to the right hand of the magnetical one, the variation is eafterly; but if to the left, wefterly.

EXAMPLE I.

In the latitude 53°. 20′ N. the fun's declination being 19°. 03′ N. I find by obfervation the fun's altitude to be 37°. 30′, and its magnetical azimuth to be SE. 51°. Required the variation.

$90°—53.20′ = 36°.40$, the compt. of the latitude
18.20, $\frac{1}{2}$ the compt. of the latitude
$90°—37°.30 = 52°.30′$, the compt. of the altitude.

$90°—19°.03′ = 70°.57′$, the fun's dift. from the pole
52.30 compt. of the altitude

123.27 fum

61.43 half fum

18.27 difference

9.13 half difference.

As

As the tang. of $\frac{1}{2}$ the compt. of the latitude,	18°.20′—	9.52031
Is to the tangent of $\frac{1}{2}$ the sum of the distance of the sun from the pole and complement of the altitude,	61.43—	10.26916
: : tang. of $\frac{1}{2}$ their difference	9.13—	9.21022
		19.47938
To tangent of a fourth arc,	42. 18—	9.95907

Half the compt. of the latitude	18°.20′
The 4th arc	62. 18
Their sum is the 5th arc	60. 38
Complement of the lat. subtract.	36. 40
Gives the 6th arc	23. 58

As radius	90°.00′—	10.00000
Is to the tang. of the alt.	37.30—	9.88498
: : tangent of the 6th arc	23.58—	0.64790
Co-sine of the sun's true azim.	70.04—	9.53288

True azimuth	S. 70°.04′ E.
Magnetical azimuth	S. 51. 00 E.
Variation	19.04 W.

The true azimuth being to the left of the magnetical one, the variation is westerly.

EXAM-

EXAMPLE II.

Suppofe the fun's true azimuth N. 83°.20′ E. but the magnetical one N. 70°.30′ E. Required the variation.

True azimuth	N. 83°.20′ E.
Magnetical azimuth	N. 70. 30 E.
Variation	12. 50 E.

The true azimuth being to the right of the magnetical one, the variation is eafterly.

EXAMPLE III.

Suppofe the fun's true azimuth was S. 37°. 15′ W. and the magnetical one S. 44°.20′ W. Required the variation.

True azimuth	S. 37°.15′ W.
Magnetical azimnth	S. 44. 20 W.
Variation	6. 05 W.

The true azimuth being to the left of the magnetical one, the variation is wefterly.

EXAMPLE IV.

Suppofe the fun's true azimuth be S. 4°05′ W. and the magnetical one S. 3°.30 E. Required the variation.

True

True azimuth	S. 4°.05′ W.
Magnetical azimuth	S. 3. 30 E.
Variation	7. 35 E.

The true azimuth being to the right of the magnetical, the variation is eaſterly.

The variation of the compaſs was firſt obſerved at London, in the year 1580, to be one point of the compaſs eaſterly, or 11°.15′ E. after which time it became leſs; for in the year 1622 it was 6°.00′ E. in 1634 it was 4°.05′ E. and ſo continued to decreaſe till the needle coincided with the true meridian, and then there was no variation; after which the variation became weſterly, and has ever ſince increaſed to the weſtward: for in the year 1672 it was 2°.33′ W. in the year 1683 it was 4°.30′ W. at London; in 1722 it was at Dublin found to be 11°.15′ W. and in 1751 it was there found to be 19°.00′ W. but how far it will continue to move more weſterly, time and obſervations will probably be the only means to diſcover.

At Paris in 1640, the variation was 3°.00′ E. in 1666 there was no variation; but in 1681 it was 2°.30′ W. and ſtill continues to go on weſterly.

How to draw a true meridian line to a map, having the variation and magnetical meridian given.

On any magnetical meridian or parallel, upon which your map is protracted, ſet off an angle from the north towards the eaſt, equal to the degrees or quantity of variation, if it be weſterly, or from the

the north towards the weſt if it be eaſterly, and the line which conſtitutes ſuch an angle with the magnetical meridian, will be a true meridian line.

For if the variation be weſterly, the magnetical meridian will be the quantity of variation of the weſt ſide of the true meridian, but if eaſterly on the eaſt ſide, therefore the true meridian muſt be a like quantity on the eaſt ſide of the magnetical one, when the variation is weſterly, and on the weſt ſide when it is eaſterly.

How to lay out a true meridian line by the circumferentor.

If the variation be weſterly, turn the box about till the north of the needle points as many degrees from the flower-de-luce towards the eaſt of the box, or till the ſouth of the needle points the like number of degrees from the ſouth towards the weſt, as are the number of degrees contained in the variation, and the index will be then due north and ſouth; therefore if a line be ſtruck out in the direction thereof, it will be a true meridian line.

If the variation was eaſterly, let the north of the needle point as many degrees from the flower-de-luce towards the weſt of the box, or let the ſouth of the needle point as many degrees towards the eaſt, as are the number of degrees contained in the variation, and then the north and ſouth of the box will coincide with the north and ſouth points of the horizon, and conſequently a line being laid out by the direction of the index, will be a true meridian line.

This

This will be found to be very uſeful in ſetting an horizontal dial, for if you lay the edge of the index by the baſe of the ſtile of the dial, and keep the angular point of the ſtile towards the ſouth of the box, and allow the variation as before, the dial will then be due north and ſouth, and in its proper ſituation; provided the plane upon which it is fixed be duly horizontal, and the ſun be ſouth at noon; but in places where it is north at noon, the angular point of the index muſt be turned to the north.

How maps may be traced by the help of a true meridian line.

If all maps had a true meridian line laid out upon them, it would be eaſy by producing it, and drawing parallels, to make out field-notes; and by knowing the variation, and allowing it upon every bearing, and having the diſtances, you would have notes ſufficient for a trace. But a true meridian line is ſeldom to be met with, therefore we are obliged to have recourſe to the foregoing method. It is therefore adviſed to lay out a true meridian line upon every map.

How to find the difference between the preſent variation, and that at a time when a tract was formerly ſurveyed, in order to trace or run out the original lines.

If the old variation be ſpecified in the map or writings, and the preſent be known, by calculation or otherwiſe, then the difference is immediately ſeen by inſpection; but as it more frequently happens, that neither is certainly known, and as the variation of different inſtruments is not always alike at the ſame time, the followng practical method may be very uſeful, *viz.*

Go

Go to any part of the premiſes where any two adjacent corners are known; and, if one can be ſeen from the other, take their bearing; which, compared with that of the ſame line in the former ſurvey, ſhews the difference. But if trees, hills, *&c.* obſtruct the view of the object, run the line according to the given bearing, and obſerve the neareſt diſtance between the line ſo run and the corner; then,

As the length of the whole line
Is to 57.3 degrees *
So is the ſaid diſtance
To the difference of variation required.

E X A M P L E.

Suppoſe it be required to run a line which ſome years ago bore NE. 45°, diſtance 80 perches, and in running this line by the given bearing, the corner is found 20 links to the left hand; what allowance muſt be made on each bearing to trace the old lines, and what is the preſent bearing of this particular line by the compaſs?

P.	Deg.	L.
As 80 :	57.3 : :	20
25	20	
2|000	1146.0(0°. 34′	
	60	
	2)68|760.0	

Anſwer 34 minutes, or a little better than half a degree to the left hand, is the allowance required, and the line in queſtion bears N. 44°. 26′. E.

Note, The different variations do not affect the area in the calculation, as they are ſimilar in every part of the ſurvey.

A TA-

* 57.3 Is the radius of a circle (nearly) in ſuch parts as the circumference contains 360.

A TABLE *of the Sun's Declination.*

Days.	Jan. South. D.	M.	Feb. South. D.	M.	March. South. D.	M.	April. North. D.	M.	May. North. D.	M.	June. North. D.	M.	Days.
For the Years 1789, 1793, 1797.													
4	22	40	16	1	6	11	5	56	16	8	22	31	4
8	22	10	14	47	4	38	7	26	17	15	22	55	8
12	21	33	13	28	3	4	8	54	18	17	23	12	12
16	20	49	12	6	1	29	10	20	19	14	23	24	16
20	19	59	10	41	Nor.	6	11	44	20	6	23	28	20
24	19	3	9	13	1	40	13	4	20	53	23	26	24
28	18	1	7	43	3	14	14	20	21	34	23	17	28
For the Years 1790, 1794, 1798.													
4	22	42	16	5	6	17	5	50	16	4	22	29	4
8	22	12	14	51	4	43	7	21	17	11	22	54	8
12	21	35	13	33	3	10	8	49	18	13	23	11	12
16	20	52	12	11	1	35	10	15	19	11	23	23	16
20	20	2	10	46	Nor.	0	11	39	20	3	23	28	20
24	19	7	9	18	1	34	12	59	20	50	23	26	24
28	18	5	7	48	3	8	14	16	21	32	23	18	28
For the Years 1791, 1795, 1799.													
4	22	43	16	10	6	22	5	45	16	0	22	28	4
8	22	14	14	56	4	49	7	15	17	7	22	52	8
12	21	38	13	38	3	15	8	44	18	10	23	11	12
16	20	55	12	16	1	41	10	10	19	8	23	23	16
20	20	5	10	51	0	6	11	34	20	1	23	28	20
24	19	10	9	24	1N.	29	12	54	20	48	23	26	24
28	18	9	7	54	3	3	14	11	21	29	23	19	28
For the Years 1792, 1796, 1800.													
4	22	45	16	15	6	5	6	2	16	13	22	33	4
8	22	16	15	1	4	31	7	32	17	20	22	56	8
12	21	40	13	43	2	57	9	0	18	21	23	14	12
16	20	58	12	21	1	23	10	26	19	18	23	24	16
20	20	9	10	56	Nor.	12	11	49	20	18	23	28	20
24	19	14	9	29	1	47	13	9	20	6	23	26	24
28	18	13	7	59	3	20	14	26	21	37	23	16	28

A TABLE of the Sun's Declination.

Each the first Year after Leap-Year.

Days.	July. North.		August North.		Sept. North.		Oct. South.		Nov. South.		Dec. South.		Days.
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	
4	23	52	17	8	7	0	4	35	15	36	22	21	4
8	22	27	16	1	5	30	6	7	16	47	22	49	8
12	21	56	14	50	3	58	7	38	17	54	23	9	12
16	21	19	13	36	2	26	9	7	18	55	23	22	16
20	20	36	12	18	0	53	10	34	19	52	23	28	20
24	19	47	10	56	Sou.	41	11	59	20	42	23	26	24
28	18	54	9	32	2	15	13	21	21	27	23	16	28

Each the second Year after Leap-Year.

4	22	53	17	12	7	5	4	29	15	31	22	19	4
8	22	28	16	5	5	35	6	1	16	43	22	47	8
12	21	58	14	55	4	4	7	32	17	50	23	8	12
16	21	21	13	40	2	32	9	2	18	52	23	22	16
20	20	39	12	22	0	58	10	29	19	49	23	28	20
24	19	50	11	1	Sou.	35	11	54	20	40	23	26	24
28	18	57	9	37	2	9	13	16	21	25	23	17	28

Each the third Year after Leap-Year.

4	22	54	17	16	7	10	4	23	15	26	22	18	4
8	22	30	16	9	5	41	5	56	16	38	22	46	8
12	22	0	14	59	4	10	7	27	17	46	23	7	12
16	21	23	13	45	2	37	8	57	18	48	23	21	16
20	20	41	12	27	1	4	10	24	19	45	23	28	20
24	19	53	11	6	Sou.	30	11	49	20	37	23	27	24
28	19	1	9	43	2	4	13	11	21	22	23	18	28

Each being Leap-Year.

4	22	50	17	3	6	54	4	41	15	40	22	24	4
8	22	25	15	56	5	24	6	13	16	52	22	51	8
12	21	53	14	45	3	52	7	44	17	58	23	11	12
16	21	16	13	30	2	20	9	13	19	0	23	23	16
20	20	33	12	12	0	46	10	40	19	56	23	28	20
24	19	44	10	51	Sou.	47	12	5	20	46	23	26	24
28	18	50	9	27	2	21	13	26	21	30	23	16	28

Some neceſſary directions concerning ſurveys in general.

If you have a large quantity of ground to ſurvey, which conſiſts of many fields or holdings, and that it be required to map and give the reſpective contents of the ſame, it is beſt to make a ſurvey of the whole firſt, and to be ſatisfied that it is truly taken, as well as to find its content; and as you go round the land, to make a note on the ſide of your field-book at every ſtation where the boundary of any particular field or holding interſects or meets the ſurround; then proceed from any one of thoſe ſtations, and in your field-book ſay, " proceed from ſuch a ſtation," and when you have gone round that field or diviſion, inſert the ſtation you cloſe at, and ſo through the whole: a little practice can only render this ſufficiently familiar, and the method of protraction muſt be evident from the field-notes. When the whole is protracted, and you are ſatisfied of the cloſes of the particular diviſions, caſt up each ſeverally, and if the ſum of their contents be equal to the content of the whole firſt found, you may ſafely conclude that all is right.

The protraction being thus finiſhed and caſt up, transfer it on clean paper, vellum, or parchment, as before; be careful to draw your lines with a fine pen, write on it the names of the circumjacent lands, and ſet No. 1, 2, 3, 4, *&c.* in every particular field or diviſion; let every tenant's particular holding be diſtinguiſhed by a different coloured paint being run finely along the boundaries; let all the roads, rivulets, rivers, bridges, bogs, ponds, houſes, caſtles, churches, beacons (or whatever elſe may be remarkable on the ground) be diſtinguiſhed on the map. Write the title of the

the map in a neat compartment either drawn, or done from a good copper-plate graving, with the gentleman's arms. Prick off one of your parallels with the map, and on it make a mariner's compaſs, and draw a flower-de-luce to the north, and this will repreſent the magnetical north; after which ſet off the variation, which expreſs in figures, and through the center of the compaſs, let a true meridian line be drawn of about 3 inches long, by which write True Meridian. Let a ſcale be drawn, or it is ſufficient to expreſs the number of perches to an inch, the map was laid down by. Draw a reference table of three, or, if occaſion be, of four or more columns: in the firſt inſert the number of the field or holding: in the next its name, and by whom occupied: in the third the quantity of acres, roods, and perches it contains: if you have unprofitable land, as bog or mountain, let the quantity be inſerted in the fourth column; and, if it be required, you may make another column for ſtatute meaſure, and then the map is completed.

SECT. VII.

The method of dividing land, or of taking off or inclosing any given quantity.

EXAMPLE.

Plate XII. fig. 1.

Let ABCD, *&c.* be a map of ground, containing 11 acres, it is required to cut off a piece as DEFGID, that ſhall contain 5 acres.

Join any two oppoſite ſtations as D and G, with the line DG (which you may nearly judge to be the partition line) and find the area of the part DEFG, which ſuppoſe may want 3R. 20P. of the quantity you would cut off: meaſure the line DG, which ſuppoſe to be 70 perches. Divide 3R. 20P. or 140P. by 35, the $\frac{1}{2}$ of DG, and the quotient 4 will be a perpendicular for a triangle whoſe baſe is 70, and the area 140P. Let HI be drawn parallel to DG, at the diſtance of the perpendicular 4, and from I, where it cuts the boundary, draw a line to D, and that line DI will be the diviſion line; or a line from G to H will have the ſame effect; all which muſt be evident from what has been already ſaid.

But if hills, trees, &c. obſtruct the view of the points D and I from each other, it will be neceſſary, in order to run the partition line, to know its bearing; and it may be proper on ſome occaſions, to have its length; both theſe may be eaſily calculated from the common field-notes only, as in the following examples, without the trouble of any other meaſurement on the ground, or any dependence on the map and ſcale.

EXAMPLE II.

Plate XII. fig. 3.

Let ABCDEFGHIA be a tract of land, to be divided into two equal parts, by a right line from the corner I to the opposite boundary CD; required the bearing and length of the partition line IN, by calculation, from the following field-notes, *viz.*

Field-Notes and Area.

Boun.	Bearing.	Perch.
AB	N. 19°. 0′ E.	108.
BC	S. 77. 0 E.	91.
CD	S. 27. 0 E.	115.
DE	S. 52. 0 W.	58.
EF	S. 15. 30 E.	76.
FG	West.	70.9
GH	N. 36. 0 W.	47.
HI	North.	64.3
IA	N. 62. 15 W.	59.
	152A. 1R. 25.9P.	

Operation.

IABCI.		Per.	N.	S.	E.	W.	Merid. dist. &c.
IA	N. 62°$\frac{1}{4}$ W.	59	27.5			52.2	
AB	N. 19 E.	108	102.1		35.2		
BC	S. 77 E.	91		20.5	88.7		
CI				109.1		71.7	
Area, 8722.3 perches.			129.6	129.6	123.9	123.9	

152A. 1R. 25.9P. = 24385.9 perch.
half, to be divided off, = 12192.9 } subt.
the part I A B C I = 8722.3 }

Triangle I C N I = 3470.6 perch.

ICDI.

ICDI.		Per.	N.	S.	E.	W.	Mer. dif. &c.
IC	N. ------ E.	-------	109.1	-------	71.7	------	
CD	S. 27 E.	115	-------	102.5	52.2	------	
DI	———------	-------	-------	6.6	-------	123.9	
Area, 6522.1		per.	109.1	109.1	123 9	123.9	

Then, as { ICDI : CD : : ICNI : CN } Th. 18 Sec. 1
{ 6522.1 : 115 : : 3470.6 : 61.19 }
which determines the point N in CD.

ICNI.		Per.	N.	S.	E.	W.
IC	as before	-------	109.1	--------	71.7	-------
CN	S. 27 E.	61.2	-------	54.5	27.8	-------
NI	———------	-------	-------	54.6	-------	99.5

As dif. lat.		54.6	As S. Bear.		61° 15′
: Radius	S.	90 deg.	: Depart.		99.5
: : Depart.		99.5	: : Radius	S.	90 deg.
: Tang. Bear.		61° 15′	: Distance		113.49

Answer, { IN runs N. 61° 15′ E. / NI runs S. 61 15 W. } 113.5 per.

In the part IABCI, the difference between the northings and the southings of the three lines, IA, AB and BC (109.1) is the difference of latitude, and that of their eastings and westings (71.7) the departure of the line CI, which is placed thereto, so as to balance the columns; see theo. 1. sect. V; hence the content is obtained, as already taught, without the bearing or length of the line CI.

For the triangle ICDI, the diff. lat. and dep. of IC are taken from the preceding table, which in going from I to C will be northing and easting; those of CD are found by the bearing and distance, and of DI by balancing the columns, as before for CI.

The

The difference of latitude (54.6) and departure (99.5) of the line NI, in the third table, are found by balancing those of IC and CN; and as they are the base and perpendicular of a right angled triangle, of which the line NI is the hypothenuse, and the angle opposite to the departure, the Bearing, we have the answer by two trigonometrical statings, as above; and thus may any tract be accurately divided, or any proposed quantity readily cut off or inclosed.

Now, the student or practitioner may calculate the content of the part ABCNIA (the bearing and distance, or the diff. lat. and dep. of CN and of NI being known) and if it be found equal to the intended quantity, it proves the truth of the operation.

EXAMPLE III.

Plate XII. fig. 3.

It is proposed to cut off 38A. 16½P. to the south end of this tract, by a line running from E due West 40 perches to a well at O, and from thence a right line to a point M in the boundary HI; the place of M, and the bearing and length of the line OM are required; the field-notes being as in example 2d.

Answer, $\left\{\begin{array}{l}\text{M from H, north, } 43.23 \\ \text{OM, N. } 78^{\circ}\ 7'\ \text{W. } 39.03\end{array}\right\}$ perches.

In this example we find,

			Perches.
The area of	OEFGHO	=	5270.5
Consequently of	HOMH	=	826.0
Dif. lat. of the line HO	= HV	=	35.2
Departure of ditto	= OV	=	38.2

As

As HI happens to be a meridian, the area of HOMH divided by half OV (19.1) quotes HM (43.23) without finding the area of HOIH, as we did of ICDI in example 2d. and HM—HV = VM = 8.03 = diff. lat. of OM, which, with its dep. VO = 38.2, gives the bearing and distance as before.

EXAMPLE IV.

Plate XII. fig. 4.

A trapezoidal field ABCD, bounded as under specified, is to be divided into two equal parts by a right line EF parallel to AB or CD; required AF or BF?

Bou.	Bearing.	Per.
AB	South.	30.
BC	N. 80 W.	60.
CD	N. 39½ W.	45.5
DA	S. 80 E.	89.4
13A. 3R. 7P.		

In the triangle CBG are given BC and all the angles (known by the bearings) to find BG, and thence the area by prob. 9. sect. 4. which + half the area of ABCD = area of EFG; then, as the area of CBG to that of EFG, so is the square of BG to the square of FG, and FG—BG = BF.

Operation

Operation at large.

Angle G 39° 30′, log. S. Co. Ar.	0.19649	
Side BC 60 per. log.	1.77815	add
Angle C 40° 30′, ſine	9.81254	
Side BG 61.26 per.	1.78718	
Side BC 60 per.	1.77815	add
Angle B 100° 0′, ſine	9.99335	
2)3619.8, log.	3.55868	
As CBG = 1809.9 Co. Ar.	6.74235	
1103.5 = BCEF		
To EFG = 2913.4, log.	3.46440	add
So ſqr. BG 61.26, log.	1.78718	
	1.78718	
To ſqr. FG 77.72	(2)3.78111	
Anſr. BF = 16.46 per.	1.89055	

By the application of this method a tract of land may be divided accurately, in any proportion, by a line running in any aſſigned direction.

Note. When the practitioner would wiſh to be very accurate, it will be much better to work by four-pole chains and links than by perches and tenths; one tenth of a perch ſquare being equal to $6\frac{1}{4}$ ſquare links.

EXAM-

EXAMPLE V.

The following Field-Notes (from A. Burns) *are of a piece of land, which is proposed, as an Example, to be divided into three equal parts, by two right-lines running from the sixth and seventh stations; and proved, by calculating the content of the middle part.*

St.	Bearing.	4P.C.
1	N.E. 56° 1/4	21.60
2	N.E. 26 1/2	13.44
3	S.E. 71 1/2	18.96
4	S.E. 26 1/2	13.44
5	S.W. 71 1/2	18.96
6	S.E. 45	8.47
7	S.E. 63 1/2	13.44
8	N.E. 45	8.47
9	S.E. 26 1/2	13.44
10	S.W. 45	8.47
11	S.W. 63 1/2	13.44
12	N.W. 76	24.73
13	N.W. 36 3/4	30.00
	A. R.	P.
Area	167. 1.	24.

EXAMPLE VI.

Plate VIII. fig. 5.

The plot ABCDEFGHA is propoſed to be divided, *geometrically*, in the proportion of 2 to 3, by a right-line from a given point in any boundary or angle thereof, ſuppoſe the point D.

Reduce the plot to the triangle cDe, as already taught; divide the baſe ce in the point N, ſo that eN be to Nc in the ratio of two to three, by prob. 14. page 53; draw DN, and it is done.

EXAMPLE VII.

Plate XII. fig. 3.

Example 2d. may likewiſe be performed geometrically.

Produce CD both ways for a baſe, and reduce the whole to a triangle, making I the vertical point; then biſect the baſe in N, and draw IN. But,

Notwithſtanding this geometrical method is demonſtrably true in theory, it is not as ſafe, on practical occaſions requiring accuracy, as the calculation, even when performed with the greateſt care; for which reaſon we will not enlarge on it here.

EXAMPLE VIII.

Suppoſe 864 acres to be laid out in form of a right-angled parallelogram, of which the ſides ſhall be in proportion as 5 to 3; required their Dimenſions?

For the greater ſide, multiply the area by the greater number of the given proportion, and divide by the

the leſs; or, for the leſs ſide, multiply by the leſs number, and divide by the greater; the ſquare-root of the quotient will be the ſide required; thus,

$$\begin{array}{rr@{\qquad}r}
864A. = & 138240\ P. & 138240 \\
 & 5 & 3 \\
\hline
 & 3)691200 & 5)414720 \\
\hline
\end{array}$$

Anſw. $\sqrt{230400} = 480.$ $\sqrt{82944} = 288.$

E x a m p l e IX.

If it be required to lay out any quantity of ground, ſuppoſe 47A. 2R. 16P. in form of a parallelogram, of which the length is to exceed the breadth by a given difference, for inſtance 80 perches, then, add the ſquare of half this difference to the area, and take the ſquare-root of the ſum; to which add half the difference for the greater ſide, and ſubſtract it therefrom for the leſs; thus,

$$\begin{array}{r@{\qquad}lr}
2)80 & 47A.\ 2R.\ 16P. = & 7616 \text{ perches.} \\
\hline
 & & 1600 \\
40 & & \\
40 & & \sqrt{9216} = 96 \\
\hline
1600 & \text{half dif. add and ſubt.} & - 40
\end{array}$$

Anſw. $\begin{cases} \text{the length} = 136 \\ \text{the breadth} = 56 \end{cases}$

Any propoſed quantity of ground may be laid out or incloſed in the form

of a { Square - - by prob. 2d.
Parallelogram, 1 ſide giv. by pro. 4th.
Triangle of a given baſe, by pro. 7th.
Circle - by prob. 13th. } ſec. IV.

It

It is ſometimes moſt convenient, when land is to be laid out adjacent to a creek, river, or other crooked boundary, to meaſure off-ſets to the angles or bendings thereof, from a right-line or lines taken near ſuch boundary, and to deduct the area of theſe off-ſets from the given quantity, and then to lay off the remainder from the right-line or lines, in the deſired form.

In laying out new lands, attention muſt be paid to the allowance for roads, as exemplified in prob. 14th, page 195.

EXAMPLE X.

It is required to divide off 30 acres, to the ſouth eaſt end of the tract, of which the field-notes are given in example 4th, by a right-line, to run N. 20° E. See example 4th.

SECT.

SECT. VIII.

Containing the ſurveying of Harbours, &c. and Leveling.

Of ſurveying Harbours, Shoals, Sands, &c.

Plate XIII. fig. 1.

THERE are three methods whereby this may be performed; for the obſervations may be made either on the water or on the land. Thoſe made on the water are of two kinds, one by the log-line and compaſs (as in plain ſailing) meaſuring the courſe and diſtance round the ſand; and then to be plotted as a large wood, or any encloſure taken by the circumferentor.

This method I omit for two reaſons; firſt, becauſe it is to be deduced from the writers of navigation; and, ſecondly, becauſe the diſtances thus meaſured are liable to the errors of currents, which generally attend ſhoals or ſands near the ſhore.

The ſecond method, where there are no diſtances to be meaſured on the water, tho' ſtill there is one inconvenience, common alſo to the former, becauſe the bearings or obſervations are to be taken on that unſtable element (an error ſcarce mention-ed

ed by practical artists) I shall briefly hint at; and so rather choose a third, which is liable to neither of these imperfections.

Let a boat be manned out with a signal flag, a log and line, lead and line, and to observe the bearings of any land-mark, a compass with sights.

Take two or more objects or places, as A, B, C, on the shore, from whence the boat may be seen on the several parts of this shoal, and determine their relative position by bearing and distances, either before or after the other necessary observations are made.

One of the boat's crew is to sound till he finds himself on the edge of the sand, by the depth of water, and then to come to an anchor; which he is to signify to two persons on the shore, at B and C, by his signal. And then from those known land-marks, B and C, the observers are to take the bearings of the boat, and to register their observations; which, when done, they are to signify to the crew by waving a flag, or by some other signal.

And in the mean time, to prevent mistakes, let the crew take the bearings of each of these land-marks: Then weigh anchor, which suppose at D.

Then by sounding, proceed to E, and make like observations. And so at E, F, G, *&c.* till you have surrounded your sand.

And if in this process, you are about to lose the sight of one of your land-marks, suppose C, let your assistant at C, or B, who, at that time will also be

 about

about to lose the sight of the boat, by signals (before agreed on) remove to some other object before-hand agreed on, suppose to H, or K; and then to proceed as before.

Lastly, if the sand runs so far out to sea, that the object cannot be seen by the boat, nor the boat by the observer on shore; there may be rockets fired by the boat's crew, and also by the observers on shore in the night, whereby those bearings may be taken almost at as great a distance as the light can be seen. For supposing they rise but a quarter of a mile above the apparent horizon, its stay will be about 9 seconds, and its distance for this quarter of a mile will be visible about 44 miles.

But rockets rise much higher, and then the distances are much greater, whereby they are visible.

Or two boats may lie at anchor instead of the land-marks, and then you may work as before.

Now, since the land-marks B and C are fixed, their position may be laid down in the draught, as in common surveying, by plotting the distance between B and C. And then, by plotting the line BD, and the line DC, according to their position, their common intersection will give the point D. And in like manner E, F, G, *&c.* may be plotted; and so the shoals completed: And this from the bearings taken at B and C.

If this be a standing lake, environed by bogs, or other impediments; the observations at D, E, F, *&c.* by taking their opposites, may suffice to plot the same from the land-marks, A, B, C, *&c.* as well as those taken on the land; or, indeed, by the

the courſe and diſtance, as in navigation, if the water be ſmooth and without a current.

In ſea-ſhoals, it is convenient to note at each obſervation the depth of the water found by the lead, and the drift and ſetting of the current by the log and compaſs, while the boat is at anchor, which may be done with eaſe and expedition enough. For while the boat rides at an anchor, her ſtern points out the ſetting of the current, and the log and glaſs will meaſure its drift.

And theſe ought to be noted on the draught, which may be thus:

The currents may be ſhewn, by drawing a dart pointing out its ſetting, and its drift by the Roman capital letters, the depth of water by the ſmall figures, and rocks by little croſſes, *&c.*

LEVELLING.

Plate XIII. fig. 2.

LEVELLING is the art of aſcertaining the perpendicular aſcent or deſcent of one place (or more) above or below the horizontal level of another, for various intentions; and of marking out courſes for the conveyance of water, *&c.*

The *true level* is a curve conforming to the ſurface of the earth; as ABG.

The *apparent level* is a tangent to that curve; as ADE.

The

The *correction*, or allowance for the earth's curvature, is the difference between the apparent level and the true, as BD. The quantity of this correction may be known by having, in the right-angled triangle CAB, the two legs, AC = the semidiameter of the earth (=1267500 perches) and AD = the distance of the object, to find the hypothenuse CD, from which taking CB (= CA) the remainder will be the correction BD; but it may be obtained more practically, thus;

Square the distance in

$$\left\{\begin{array}{ll} \text{four-pole chains and divide by} & 800, \\ \text{or in perches and divide by} & 12800, \\ \text{or in miles and multiply by} & 8, \end{array}\right\}$$

for the correction in inches.

EXAMPLE.

Required the correction for 20 four-pole chains = 80 perches = $\frac{1}{4}$ mile?

$$800)20 \times 20 = 400(.5$$
$$12800)80 \times 80 = 6400(.5$$
$$\tfrac{1}{4} = .25, \text{ and } .25 \times .25 \times 8 = .5$$

that is .5, or $\frac{1}{2}$ inch, the correction required.

But, to save the trouble of calculation, we insert the following Table of Corrections.

A Table

A Table of Corrections.

The diſtances in four-pole chains.

Diſtan. Chains	Correc. Inches	Diſtan. Chains	Correc. Inches
1	0,00125	27	0,91
2	0,005	28	0,98
3	0,01125	29	1,05
4	0,02	30	1,12
5	0,03	31	1,19
6	0,04	32	1,27
7	0,06	33	1,35
8	0,08	34	1,44
9	0,10	35	1,53
10	0,12	36	1,62
11	0,15	37	1,71
12	0,18	38	1,80
13	0,21	39	1,91
14	0,24	40	2,00
15	0,28	45	2,28
16	0,32	50	3,12
17	0,36	55	3,78
18	0,40	60	4,50
19	0,45	65	5,31
20	0,50	70	6,12
21	0,55	75	7,03
22	0,60	80	8,00
23	0,67	85	9,03
24	0,72	90	10,12
25	0,78	95	11,28
26	0,84	100	12,50

The firſt thing neceſſary in levelling, is the adjuſting of the level, which may be performed ſeveral ways: The following is very eaſy and practical.

Chooſe ſome ground which is not above 4 or 5 feet out of the level, for the diſtance of 8 or 10 chains

chains length, and ſuppoſe it be AB (fig. 3.) and find the middle between A and B, which ſuppoſe to be C; plant the inſtrument at C; direct the tube to a ſtation-ſtaff, held up at A, and elevate or depreſs the tube, till the bubble is exactly in the middle of the diviſions; then by ſignals direct your aſſiſtant at A, to raiſe or depreſs the vane, ſliding on the ſtation-ſtaff, till the horizontal hair in the glaſs, cuts the middle of that vane; then ſee how many feet, inches, and parts, are cut by the upper part of the vane, which ſuppoſe to be 3 feet 4 inches and 6 tenths.

In like manner direct to the other ſtaff, at B, and ſuppoſe the upper edge of that vane to cut at the height of 6 feet 5 inches and two tenths; then will theſe two vanes be on a level.

From 6 feet 5.2 inches ſubtract 3 feet 4.6 inches, and reſerve the remainder 3 feet 0.6 inches.

Now, remove the inſtrument as cloſe to the higher ſtation-ſtaff as you can; ſo that the middle of the teleſcope may almoſt touch it. Then bring the teleſcope as near to a level as the judgment of the eye will direct.

Meaſure from the ground, the height of the top of the teleſcope; and alſo of the bottom, in feet, inches, and parts: Suppoſe them to be 4 feet 10.5 inches, and 5 feet 0.3 inches; then half the ſum of theſe heights 4 feet 11 4 inches is the height of the center of the glaſs; and to this add half the breadth of the vane, which ſuppoſe to be 1 inch and 5 tenths, and to the ſum 5 feet 0.9 inches, add the preceding remainder 3 feet 0.6 inches; then let the perſon at B move his vane, till the upper edge cut 8 feet 1.5 inches, the ſum of the preceding numbers.

Now,

Now, ſo elevate or depreſs the hair or the bubble, till the hair cut the middle of the vane at B, and at the ſame time the bubble ſtands in the middle of the diviſions; and then will the inſtrument be duly adjuſted.

If you have a mind to be more accurate, repeat the operation; but when you place the inſtrument at C, turn the tube at right angles to the line AB, and there ſet it level; then proceed with the repetition of the work. Only obſerve to croſs-level it in this adjuſtment, and in all future uſes whatſoever.

Or the level may be adjuſted thus: As before, firſt plant the inſtrument in the middle between A and B (fig. 4.) and obſerve the heights on the ſtation-ſtaves, which ſuppoſe to be as above; and conſequently their difference, as before, is 3 feet 0.6 inches. Now meaſure from C towards the higheſt ground A, ſome diſtance that comes almoſt to A; ſuppoſe 4 chains to D, and DB will be 9 chains, and DA one chain: Then plant the inſtrument at D, direct the teleſcope to A, and, ſetting the bubble to the middle of the diviſion, direct your aſſiſtant to move the vane, till the hair cuts the middle of it; and note down the feet, inches, and parts cut by the upper edge of the vane; which ſuppoſe to be 3 feet 8.4 inches: To this add the difference 3 feet 0.6 inches, and the ſum 6 feet 9 inches reſerve.

Now direct the teleſcope to the ſtaff at B, level it, and direct your aſſiſtant to move the vane, till the hair cuts the middle thereof; and then, if the upper edge of the vane cuts the foregoing ſum 6 feet 9 inches, the hair and bubble are truly adjuſted. But if not, ſay, As BD leſs AD, is to the difference between the numbers cut by the upper edge

edge of the vane, and the number 6 feet 9 inches; so is the diſtance AD to a number, which added to that cut by the vane, when leſs than 6 feet 9, and ſubtracted from the number cut by the vane, when it is greater than 6 feet 9, will give a number, to which let the aſſiſtant fix the vane; then ſo elevate or depreſs the hair or the bubble, till the hair cuts the middle of the vane at B, and the bubble ſtands in the middle of the diviſions; for then the level will be adjuſted. The operation may be again repeated, and at every ſtation croſs-levelled, which will confirm the former adjuſtment.

Or it will be ſtill better to ſet the ſtation ſtaves equally diſtant from the inſtrument (ſuppoſe about 16 or 20 perches each) at an angle of about 60° or ſo as to form nearly an equilateral triangle therewith, and level the 2 vanes (A and B fig. 5.) as before, which will be then both in the ſame horizontal level, whether the inſtrument be right adjuſted or not, becauſe one will be as much above or below the true level of the inſtrument, as the other, being at the ſame diſtance from it; then remove the inſtrument as near as may be to one of them, ſuppoſe A, and raiſe or lower the vane A to the exact level of the viſual ray in the inſtrument, noting preciſely how much it is moved, and have the other vane B moved juſt as much, in order to bring them again to a level, allowing for the correction of the apparent level if it be a ſenſible quantity, then adjuſt the inſtrument to the level of the vane at B.

To adjuſt the rafter level (plate 13. fig. 6.) which may be 10, 12 or 14 feet in the ſpan AB; ſet it on a plank or hard ground nearly level and mark where the plumb line cuts the beam mn, ſuppoſe at c, then invert the poſition by ſetting the foot A in the place of B, and B in that of A, marking where the

the line now cuts, as at e; the middle point between c and e will be the true levelling mark.

To continue a level courſe with this inſtrument, ſet the foot A to the ſtarting place, and move B upward or downward toward D or E, till the point B be determined and marked for a level with A, then carry the inſtrument forward in the direction of C till the foot A reſts at B, whence the point C is levell'd as before, &c. Sights may be placed at r and s and the inſtrument adjuſted to them, as before, by reverſing them in the direction of ſome diſtant object.

After the inſtrument is duly adjuſted, you may proceed to uſe it. Let the example be this annexed (fig. 7.) where A every where repreſents the level, and B the ſtation ſtaves; and ſuppoſe the route be made from a to e; firſt plant the inſtrument between the ſtaves a and b: at A direct the level to a B, bring the bubble to the middle of the diviſions, and inſtruct your aſſiſtant ſo to place the vane, that the hair in the teleſcope cuts the middle of the vane; then in a book divided into two colums, the one intituled *Back Sights*, the other *Fore Sights*, enter the feet, inches, and parts cut by the upper edge of the vane at a B, in the column intituled *Back Sights*.

Then look towards the other ſtaff b B, bring the bubble to the middle of the diviſions, and direct your aſſiſtant to place the vane ſo, that the hair cuts the middle of the vane; then enter the feet, inches, and parts cut by the upper edge of the vane, in the column of *Fore Sights*.

Now, plant the inſtrument at A 3, ſtill keeping the ſtaff Bb exactly in the ſame place, and carry the ſtaff aB forwards to the place cB; now look

 back

back to the ſtaff bB, and enter the numbers cut by the vane there, under the title *Back Sights* ; then look forwards to cB, and enter the obſervation under the title *Fore Sights.* Do the like when the inſtrument is planted at A [3], A [4], *&c.* always taking care to keep the ſtaff in the ſame place when you look'd at it for a *Fore Sight*, till you have alſo taken with it a *Back Sight.*

Having finiſhed your level, add up the column of *Back Sights* into one ſum, and the column of *Fore Sights* alſo into one ſum; and the difference between theſe ſums is the aſcent or deſcent required. And if the ſum of the *Fore Sights* be greater than the ſum of the *Back Sights*, then e is lower than a; but if the ſum of the *Fore Sights* be leſs than the ſum of the *Back Sights*, e is higher than a. For example let the numbers be as in the following table.

Back Sights.			*Fore Sights.*		
Feet.	Inch.	Tenths.	Feet.	Inch.	Tenths.
3 .	7 ,	5	6 .	4 ,	5
4 .	6 ,	8	8 .	3 ,	2
6 .	0 ,	2	5 .	4 ,	7
9 .	5 ,	0	8 .	7 ,	8
1 .	0 ,	7	9 .	4 ,	8
24 .	8 ,	2	38 .	1 ,	0
			24 .	8 ,	2
			13 .	4 ,	8

Hence the deſcent is 13 . 4 , 8

Some

Some observations to be noticed.

1. And if the diſtances thus taken are ſhort, the curvature of the earth may be rejected. For, if the diſtance from the inſtrument be every where about 100 yards, all the curvatures in a mile's work will be leſs than half an inch.

2. If the diſtances from the inſtrument to the hindermoſt ſtaff, be every where equal to the diſtance from the inſtrument to the correſponding ſtaff; the curvature of the earth, and the minute errors of the inſtrument will both be deſtroyed. Hence it will be much beſt to ſet the inſtrument as equally diſtant from both ſtaves as may be.

3. If the diſtances of the inſtrument from the ſtaves, be very unequal and very long, the curvatures muſt be accounted for, and the diſtances, in order thereto, muſt be meaſured.

4. Therefore it appears, that the beſt method to take a level, is to meaſure the ſeveral diſtances from the inſtrument to the back and forward ſtation ſtaves; and enter them in the field-book, according to the titles of their ſeveral columns, as in the following example; and correct the heights from the table of allowances; which may be done at home, when you are about to ſum up the heights.

Backwards.

Backwards.			Forwards.		
Diſtan.	Height	Corrected	Diſtan.	Height	Corrected
Links	Inches	Inches	Links	Inches	Inches
370	3,25	3,24	418	4,36	4,34
430	6,10	6,08	328	7,18	7,17
760	5,38	5,31	289	6,75	6,67
584	7,25	7,21	530	9,53	9,50
326	8,15	8,14	485	11,25	11,22
658	10,25	10,20	376	8,65	8,63
530	6,32	6,29	720	10,34	10,28
3658		46,47	31,46		57,81
3146					46,47
68,04					11,34

So that the fall in 68 chains is about 11 inches and $\frac{1}{3}$ of an inch.

Laſtly, Though hitherto we have conſidered the level with one teleſcope only, the ſame obſervations may be applied to a level with a double teleſcope; and I would adviſe thoſe who uſe the double teleſcope, at every ſtation to turn that end of the teleſcope forward, which before was the contrary way.

A more general method of levelling, adapted to the ſurveying of roads and hilly ground, is exhibited in the following example, in which the meaſures are given in links.

EXAMPLE.

Plate XIII. fig. 8.

Required the bearing and diſtance of the place B from A, and its perpendicular aſcent or deſcent, above or below the horizontal level of A.

Stat.

Stat.	Course or Bearing.	Elev. or Depres.	Obl. Dist.	Hor. Dist.	Perpen. Ascent or Desc.	Dif. Lat.	Depart.
1	NE 79° 15′	D 17° 15′	738	705	218.9	131	692
2	NE 75 00	D 21 45	684	635	253.4	164	613
3	NE 50 30	E 14 00	976	947	236.1	602	730
4	SE 85 15	D 11 30	930	911	185.4	75	908
5	SE 70 00	E 19 15	620	585	204.0	200	549
			3948	3783	217.6 Desc.	622 N.	3492 E.

As Dif. Lat. 622
Is to Radius S. 90°,
So is Dep. 3492
To T. Bear. 79° 54′.

As S. Bear. 79° 54′
Is to Dep. 3492,
So is Radius S. 90°
To Dist. 3547.

As 100 links : 66 feet : : 217.6 links : 143.6 feet, the descent of B below the level of A.

Hence, B bears N. 79° 54′ E. from A.
Nearest horiz. dist. 3547 links.
Sum of obl. dist. 3948 links.
Sum of horiz. dist. 3783 links.
Perp. desc. 217.6 L. = 143.6 F.
} answer.

With the angular elevation or depression in the third column, and the oblique distance in the fourth (as course and distance) are found the horizontal distance in the fifth, and the perpendicular ascent or descent in the sixth, for each station (as difference of latitude and departure:) then, with the bearing and horizontal distance we get the difference of latitude and departure in the two last columns.

The ascents and descents in the sixth column are distinguished by the letters E and D in the third, signifying

nifying elevation or depreſſion; and being added ſeparately, the difference of their ſums is ſet at the bottom of the column with the name of the greater, and ſhews the perpendicular deſcent of B below the horizontal level of A.

In like manner the northings and ſouthings in the ſeventh column are diſtinguiſhed by the letters N and S in the ſecond, &c.

PROMISCUOUS QUESTIONS.

1. The perambulator, or ſurveying wheel, is ſo contrived as to turn juſt twice in the length of a pole, or $16\frac{1}{2}$ feet; what then is the diameter?

Anſw. 2.626 feet.

2. Two ſides of a triangle are reſpectively 20 and 40 perches; required the third ſo that the content may be juſt an acre?

Anſw. either 23.099 or 58.876 perches.

3. I want the length of a line by which my gardener may ſtrike out a round orangery that ſhall contain juſt half an acre of ground.

Anſw. $27\frac{3}{4}$ yards.

4. What proportion does the arpent of France, which contains 100 ſquare poles of 18 feet each, bear to the American acre, containing 160 ſquare poles of 16.5 feet each, conſidering that the length of the French foot is to the American as 16 to 15?

Anſw. as 512 to 605.

5. The ellipſe in Groveſnor ſquare meaſures 840 links the longeſt way, and 612 the ſhorteſt, within the rails: now the wall being 14 inches thick, it is required to find what quantity of ground it incloſes, and how much it ſtands upon?

Anſw. it incloſes 4A. 6P. and ſtands on $1760\frac{1}{2}$ ſquare feet.

6. Required the dimenſions of an elliptical acre, with the greateſt and leaſt diameters in the proportion of 3 to 2?

Anſw. 17.479 by 11.653 perches.

7. The paving of a triangular court, at 18*d.* per foot, came to 100*l.* The longeſt of the three ſides was 88 feet: what then was the ſum of the other two equal ſides? Anſw. 106.85 feet.

8. In 110 acres of ſtatute meaſure, in which the pole is $16\frac{1}{2}$ feet, how many Cheſhire acres, where the cuſtomary pole is 6 yards, and how many of Ireland, where the pole in uſe is 7 yards.

Anſw. 92A. 1R. 28P. Cheſhire; 67A. 3R. 25P. Iriſh.

9. The three ſides of a triangle containing 6A. 1R. 12P. are in the ratio of the three numbers, 9, 8, 6, reſpectively; required the ſides?

Anſw. 59.029, 52.47, and 39.353.

10. In a pentangular field, beginning with the ſouth ſide, and meaſuring round towards the eaſt, the firſt or ſouth ſide is 2735 links, the ſecond 3115, the third 2370, the fourth 2925, and the fifth 2220; alſo the diagonal from the firſt angle to the third is 3800 links, and that from the third to the fifth 4010: required the area of the field?

Anſw. 117A. 2R. 28P.

11. Required

11. Required the dimenſions of an oblong garden, containing three acres, and bounded by 104 perches of pale fence?

Anſw. 40 perches by 12.

12. How many acres are contained in a ſquare meadow, the diagonal of which is 20 perches more than either of its ſides?

Anſw. 4A. 2R. 11P.

13. If a man ſix feet high travel round the earth, how much greater will be the circumference deſcribed by the top of his head, than that by his feet?

Anſw. 37.69 feet.

N. B. the required difference is equal to the circumference of a circle of 6 feet radius, let the magnitude of the earth be what it may.

14. Required the dimenſions of a parallelogram containing 200 acres, which is 40 perches longer than wide?

Anſw. 200 perches by 160.

15. What difference is there between a lot 28 perches long by 20 broad, and two others each of half thoſe dimenſions?

Anſw. 1A. 3R.

F I N I S.

TABLES

OF

DIFFERENCE

OF

LATITUDE AND DEPARTURE:

CONSTRUCTED

TO EVERY QUARTER OF A DEGREE
OF THE QUADRANT,

AND CONTINUED FROM ONE, TO THE
DISTANCE OF ONE HUNDRED
MILES OR CHAINS.

1829

PHILADELPHIA:

PRINTED AND SOLD BY *JOSEPH CRUKSHANK*, IN MARKET-
STREET, BETWEEN SECOND AND THIRD-STREETS.

M DCC XC. 1831

Dist.	¼ Deg.		½ Deg.		¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	1,00	0,00	1,00	0,01	1,00	0,01	1
2	2,00	0,01	2,00	0,02	2,00	0,03	2
3	3,00	0,01	3,00	0,03	3,00	0,04	3
4	4,00	0,02	4,00	0,03	4,00	0,05	4
5	5,00	0,02	5,00	0,04	5,00	0,07	5
6	6,00	0,03	6,00	0,05	6,00	0,08	6
7	7,00	0,03	7,00	0,06	7,00	0,09	7
8	8,00	0,03	8,00	0,07	8,00	0,10	8
9	9,00	0,04	9,00	0,08	9,00	0,12	9
10	10,00	0,04	10,00	0,09	10,00	0,13	10
11	11,00	0,05	11,00	0,10	11,00	0,14	11
12	12,00	0,05	12,00	0,10	12,00	0,16	12
13	13,00	0,06	13,00	0,11	13,00	0,17	13
14	14,00	0,06	14,00	0,12	14,00	0,18	14
15	15,00	0,07	15,00	0,13	15,00	0,20	15
16	16,00	0,07	16,00	0,14	16,00	0,21	16
17	17,00	0,07	17,00	0,15	17,00	0,22	17
18	18,00	0,08	18,00	0,16	18,00	0,24	18
19	19,00	0,08	19,00	0,17	19,00	0,25	19
20	20,00	0,09	20,00	0,17	20,00	0,26	20
21	21,00	0,09	21,00	0,18	21,00	0,27	21
22	22,00	0,10	22,00	0,19	22,00	0,29	22
23	23,00	0,10	23,00	0,20	23,00	0,30	23
24	24,00	0,10	24,00	0,21	24,00	0,31	24
25	25,00	0,11	25,00	0,22	25,00	0,33	25
26	26,00	0,11	26,00	0,23	26,00	0,34	26
27	27,00	0,12	27,00	0,24	27,00	0,35	27
28	28,00	0,12	28,00	0,24	28,00	0,37	28
29	29,00	0,13	29,00	0,25	29,00	0,38	29
30	30,00	0,13	30,00	0,26	30,00	0,39	30
31	31,00	0,14	31,00	0,27	31,00	0,41	31
32	32,00	0,14	32,00	0,28	32,00	0,42	32
33	33,00	0,14	33,00	0,29	33,00	0,43	33
34	34,00	0,15	34,00	0,30	34,00	0,45	34
35	35,00	0,15	35,00	0,31	35,00	0,46	35
36	36,00	0,16	36,00	0,31	36,00	0,47	36
37	37,00	0,16	37,00	0,32	37,00	0,48	37
38	38,00	0,17	38,00	0,33	38,00	0,50	38
39	39,00	0,17	39,00	0,34	39,00	0,51	39
40	40,00	0,17	40,00	0,35	40,00	0,52	40
41	41,00	0,18	41,00	0,36	41,00	0,54	41
42	42,00	0,18	42,00	0,37	42,00	0,55	42
43	43,00	0,19	43,00	0,38	43,00	0,56	43
44	44,00	0,19	44,00	0,38	44,00	0,58	44
45	45,00	0,20	45,00	0,39	45,00	0,59	45
46	46,00	0,20	46,00	0,40	46,00	0,60	46
47	47,00	0,21	47,00	0,41	47,00	0,62	47
48	48,00	0,21	48,00	0,42	48,00	0,63	48
49	49,00	0,21	49,00	0,43	49,00	0,64	49
50	50,00	0,22	50,00	0,44	50,00	0,65	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	89¾ Deg.		89½ Deg.		89¼ Deg.		

Dist.	$\frac{1}{4}$ Deg. Lat.	$\frac{1}{4}$ Deg. Dep.	$\frac{1}{2}$ Deg. Lat.	$\frac{1}{2}$ Deg. Dep.	$\frac{3}{4}$ Deg. Lat.	$\frac{3}{4}$ Deg. Dep.	Dist.
51	51,00	0,22	51,00	0,45	51,00	0,67	51
52	52,00	0,23	52,00	0,45	52,00	0,68	52
53	53,00	0,23	53,00	0,46	53,00	0,69	53
54	54,00	0,24	54,00	0,47	54,00	0,71	54
55	55,00	0,24	55,00	0,48	55,00	0,72	55
56	56,00	0,24	56,00	0,49	56,00	0,73	56
57	57,00	0,25	57,00	0,50	57,00	0,75	57
58	58,00	0,25	58,00	0,51	57,99	0,76	58
59	59,00	0,26	59,00	0,51	58,99	0,77	59
60	60,00	0,26	60,00	0,52	59,99	0,79	60
61	61,00	0,27	61,00	0,53	60,99	0,80	61
62	62,00	0,27	62,00	0,54	61,99	0,81	62
63	63,00	0,27	63,00	0,55	62,99	0,82	63
64	64,00	0,28	64,00	0,56	63,99	0,84	64
65	65,00	0,28	65,00	0,57	64,99	0,85	65
66	66,00	0,29	66,00	0,58	65,99	0,86	66
67	67,00	0,29	67,00	0,58	66,99	0,88	67
68	68,00	0,30	68,00	0,59	67,99	0,89	68
69	69,00	0,30	69,00	0,60	68,99	0,90	69
70	70,00	0,31	70,00	0,61	69,99	0,92	70
71	71,00	0,31	71,00	0,62	70,99	0,93	71
72	72,00	0,31	72,00	0,63	71,99	0,94	72
73	73,00	0,32	73,00	0,64	72,99	0,96	73
74	74,00	0,32	74,00	0,65	73,99	0,97	74
75	75,00	0,33	75,00	0,65	74,99	0,98	75
76	76,00	0,33	76,00	0,66	75,99	0,99	76
77	77,00	0,34	77,00	0,67	76,99	1,01	77
78	78,00	0,34	78,00	0,68	77,99	1,02	78
79	79,00	0,34	79,00	0,69	78,99	1,03	79
80	80,00	0,35	80,00	0,70	79,99	1,05	80
81	81,00	0,35	81,00	0,71	80,99	1,06	81
82	82,00	0,36	82,00	0,72	81,99	1,07	82
83	83,00	0,36	83,00	0,72	82,99	1,09	83
84	84,00	0,37	84,00	0,73	83,99	1,10	84
85	85,00	0,37	85,00	0,74	84,99	1,11	85
86	86,00	0,38	86,00	0,75	85,99	1,13	86
87	87,00	0,38	87,00	0,76	86,99	1,14	87
88	88,00	0,38	88,00	0,77	87,99	1,15	88
89	89,00	0,39	89,00	0,78	88,99	1,16	89
90	90,00	0,39	90,00	0,79	89,99	1,18	90
91	91,00	0,40	91,00	0,79	90,99	1,19	91
92	92,00	0,40	92,00	0,80	91,99	1,20	92
93	93,00	0,41	93,00	0,81	92,99	1,22	93
94	94,00	0,41	94,00	0,82	93,99	1,23	94
95	95,00	0,41	95,00	0,83	94,99	1,24	95
96	96,00	0,42	96,00	0,84	95,99	1,26	96
97	97,00	0,42	97,00	0,85	96,99	1,27	97
98	98,00	0,43	98,00	0,86	97,99	1,28	98
99	99,00	0,43	99,00	0,86	98,99	1,30	99
100	100,0	0,44	100,0	0,87	99,99	1,31	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	$89\frac{3}{4}$ Deg.		$89\frac{1}{2}$ Deg.		$89\frac{1}{4}$ Deg.		

Dist.	1 Deg.		1¼ Deg.		1½ Deg.		1¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	1,00	0,02	1,00	0,02	1,00	0,03	1,00	0,03	1
2	2,00	0,03	2,00	0,04	2,00	0,05	2,00	0,06	2
3	3,00	0,05	3,00	0,07	3,00	0,08	3,00	0,09	3
4	4,00	0,07	4,00	0,09	4,00	0,10	4,00	0,12	4
5	5,00	0,09	5,00	0,11	5,00	0,13	5,00	0,15	5
6	6,00	0,10	6,00	0,13	6,00	0,16	6,00	0,18	6
7	7,00	0,12	7,00	0,15	7,00	0,18	7,00	0,21	7
8	8,00	0,14	8,00	0,17	8,00	0,21	8,00	0,25	8
9	9,00	0,16	9,00	0,20	9,00	0,24	9,00	0,28	9
10	10,00	0,17	10,00	0,22	10,00	0,26	10,00	0,31	10
11	11,00	0,19	11,00	0,24	11,00	0,28	10,99	0,34	11
12	12,00	0,21	12,00	0,26	12,00	0,31	11,99	0,37	12
13	13,00	0,23	13,00	0,28	13,00	0,34	12,99	0,40	13
14	14,00	0,24	14,00	0,31	14,00	0,37	13,99	0,43	14
15	15,00	0,26	15,00	0,33	14,99	0,39	14,99	0,46	15
16	16,00	0,28	16,00	0,35	15,99	0,42	15,99	0,49	16
17	17,00	0,30	17,00	0,37	16,99	0,45	16,99	0,52	17
18	18,00	0,31	18,00	0,39	17,99	0,47	17,99	0,55	18
19	19,00	0,33	19,00	0,41	18,99	0,50	18,99	0,58	19
20	20,00	0,35	20,00	0,44	19,99	0,52	19,99	0,61	20
21	21,00	0,37	21,00	0,46	20,99	0,55	20,99	0,64	21
22	22,00	0,38	21,99	0,48	21,99	0,58	21,99	0,67	22
23	23,00	0,40	22,99	0,50	22,99	0,60	22,99	0,70	23
24	24,00	0,42	23,99	0,52	23,99	0,63	23,99	0,73	24
25	25,00	0,44	24,99	0,55	24,99	0,65	24,99	0,76	25
26	26,00	0,45	25,99	0,57	25,99	0,68	25,99	0,79	26
27	27,00	0,47	26,99	0,59	26,99	0,71	26,99	0,83	27
28	28,00	0,49	27,99	0,61	27,99	0,73	27,99	0,86	28
29	29,00	0,51	28,99	0,63	28,99	0,76	28,99	0,89	29
30	30,00	0,52	29,99	0,65	29,99	0,79	29,99	0,92	30
31	31,00	0,54	30,99	0,68	30,99	0,81	30,99	0,95	31
32	32,00	0,56	31,99	0,70	31,99	0,84	31,99	0,98	32
33	32,99	0,58	32,99	0,72	32,99	0,86	32,98	1,01	33
34	33,99	0,59	33,99	0,74	33,99	0,89	33,98	1,04	34
35	34,99	0,61	34,99	0,76	34,99	0,92	34,98	1,07	35
36	35,99	0,63	35,99	0,79	35,99	0,94	35,98	1,10	36
37	36,99	0,65	36,99	0,81	36,99	0,97	36,98	1,13	37
38	37,99	0,66	37,99	0,83	37,99	0,99	37,98	1,16	38
39	38,99	0,68	38,99	0,85	38,99	1,02	38,98	1,19	39
40	39,99	0,70	39,99	0,87	39,99	1,05	39,98	1,22	40
41	40,99	0,72	40,99	0,89	40,99	1,07	40,98	1,25	41
42	41,99	0,73	41,99	0,92	41,99	1,10	41,98	1,28	42
43	42,99	0,75	42,99	0,94	42,99	1,13	42,98	1,31	43
44	43,99	0,77	43,99	0,96	43,99	1,15	43,98	1,34	44
45	44,99	0,79	44,99	0,98	44,99	1,18	44,98	1,37	45
46	45,99	0,80	45,99	1,00	45,99	1,20	45,98	1,40	46
47	46,99	0,82	46,99	1,03	46,99	1,23	46,98	1,44	47
48	47,99	0,84	47,99	1,05	47,98	1,26	47,98	1,47	48
49	48,99	0,86	48,99	1,07	48,98	1,28	48,98	1,50	49
50	49,99	0,87	49,99	1,09	49,98	1,31	49,98	1,53	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	89 Deg.		88¾ Deg.		88½ Deg.		88¼ Deg.		

Dist.	1 Deg. Lat.	1 Deg. Dep.	1¼ Deg. Lat.	1¼ Deg. Dep.	1½ Deg. Lat.	1½ Deg. Dep.	1¾ Deg. Lat.	1¾ Deg. Dep.	Dist.
51	50,99	0,89	50,99	1,11	50,98	1,34	50,98	1,56	51
52	51,99	0,91	51,99	1,13	51,98	1,36	51,98	1,59	52
53	52,99	0,92	52,99	1,16	52,98	1,39	52,98	1,62	53
54	53,99	0,94	53,99	1,18	53,98	1,41	53,97	1,65	54
55	54,99	0,96	54,99	1,20	54,98	1,44	54,97	1,68	55
56	55,99	0,98	55,99	1,22	55,98	1,47	55,97	1,71	56
57	56,99	0,99	56,99	1,24	56,98	1,49	56,97	1,74	57
58	57,99	1,01	57,99	1,27	57,98	1,52	57,97	1,77	58
59	58,99	1,03	58,99	1,29	58,98	1,54	58,97	1,8c	59
60	59,99	1,05	59,99	1,31	59,98	1,57	59,97	1,83	60
01	60,99	1,06	60,99	1,33	60,98	1,60	60,97	1,86	61
62	61,99	1,08	61,99	1,35	61,98	1,62	61,97	1,89	62
63	62,99	1,10	62,99	1,37	62,98	1,65	62,97	1,92	63
64	63,99	1,12	63,98	1,40	63,98	1,68	63,97	1,95	64
65	64,99	1,13	64,98	1,42	64,98	1,70	64,97	1,99	65
66	65,99	1,15	65,98	1,44	65,98	1,73	65,97	2,02	66
67	66,99	1,17	66,98	1,46	66,98	1,75	66,97	2,05	67
68	67,99	1,19	67,98	1,48	67,98	1,78	67,97	2,08	68
69	68,99	1,20	68,98	1,51	68,98	1,81	68,97	2,11	69
70	69,99	1,22	69,98	1,53	69,98	1,83	69,97	2,14	70
71	70,99	1,24	70,98	1,55	70,98	1,86	70,97	2,17	71
72	71,99	1,26	71,98	1,57	71,98	1,88	71,97	2,20	72
73	72,99	1,27	72,98	1,59	72,97	1,91	72,97	2,23	73
74	73,99	1,29	73,98	1,61	73,97	1,94	73,97	2,26	74
75	74,99	1,31	74,98	1,64	74,97	1,96	74,97	2,29	75
76	75,99	1,33	75,98	1,66	75,97	1,99	75,96	2,32	76
77	76,99	1,34	76,98	1,68	76,97	2,02	76,96	2,35	77
78	77,99	1,36	77,98	1,70	77,97	2,04	77,96	2,38	78
79	78,99	1,38	78,98	1,72	78,97	2,07	78,96	2,41	79
80	79,99	1,40	79,98	1,75	79,97	2,09	79,96	2,44	80
81	80,99	1,41	80,98	1,77	80,97	2,12	80,90	2,47	81
82	81,99	1,43	81,98	1,79	81,97	2,15	81,96	2,50	12
83	82,99	1,45	82,98	1,81	82,97	2,17	82,96	2,53	83
84	83,99	1,47	83,98	1,83	83,97	2,20	83,96	2,57	84
85	84,99	1,48	84,98	1,85	84,97	2,23	84,96	2,60	85
86	85,99	1,50	85,98	1,88	85,97	2,25	85,96	2,63	86
87	86,99	1,52	86,98	1.90	86,97	2,28	86,96	2,66	87
88	87,99	1,54	87,98	1,92	87,97	2,30	87,96	2,69	88
89	88,99	1,55	88,98	1,94	88,97	2,33	88,96	2,72	89
90	89,99	1,57	89,98	1,96	89,97	2,36	89,96	2,75	90
91	90,99	1,59	90,98	1,99	90,97	2,38	90,96	2,78	91
92	91,99	1,61	91,98	2,01	91,97	2,41	91,96	2,81	92
93	92,99	1,62	92,98	2,03	92,97	2,43	92,96	2,84	93
94	93,99	1,64	93,98	2,05	93,97	2,46	93,96	2,87	94
95	94,99	1,66	94,98	2,07	94,97	2,49	94,96	2,90	95
96	95,99	1,68	95,98	2,09	95,97	2,51	95,96	2,94	96
97	96,99	1,69	96,98	2,12	96,97	2,54	96,95	2,96	97
98	97,99	1,71	97,98	2,14	97,97	2,57	97,95	2,99	98
99	98,98	1,73	98,98	2,16	98,97	2,59	98,95	3,02	99
100	99,98	1,75	99,98	2,18	99,97	2,62	99,95	3,05	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	89 Deg.		88¾ Deg.		88½ Deg.		88¼ Deg.		

Dist.	2 Deg. Lat.	2 Deg. Dep.	2¼ Deg. Lat.	2¼ Deg. Dep.	2½ Deg. Lat.	2½ Deg. Dep.	2¾ Deg. Lat.	2¾ Deg. Dep.	Dist.
1	1,00	0,03	1,00	0,04	1,00	0,04	1,00	0,05	1
2	2,00	0,07	2,00	0,08	2,00	0,09	2,00	0,10	2
3	3,00	0,10	3,00	0,12	3,00	0,13	3,00	0,14	3
4	4,00	0,14	4,00	0,16	4,00	0,17	4,00	0,19	4
5	5,00	0,17	5,00	0,20	5,00	0,22	4,99	0,24	5
6	6,00	0,21	6,00	0,24	5,99	0,26	5,99	0,29	6
7	7,00	0,24	6,99	0,27	6,99	0,31	6,99	0,34	7
8	7,99	0,28	7,99	0,31	7,99	0,35	7,99	0,38	8
9	8,99	0,31	8,99	0,35	8,99	0,39	8,99	0,43	9
10	9,99	0,35	9,99	0,39	9,99	0,44	9,99	0,48	10
11	10,99	0,38	10,99	0,43	10,99	0,48	10,99	0,53	11
12	11,99	0,42	11,99	0,47	11,99	0,52	11,99	0,58	12
13	12,99	0,45	12,99	0,51	12,99	0,57	12,99	0,62	13
14	13,99	0,49	13,99	0,55	13,99	0,61	13,98	0,67	14
15	14,99	0,52	14,99	0,59	14,99	0,65	14,98	0,72	15
16	15,99	0,56	15,99	0,63	15,99	0,70	15,98	0,77	16
17	16,99	0,59	16,99	0,67	16,98	0,74	16,98	0,82	17
18	17,99	0,63	17,99	0,71	17,98	0,79	17,98	0,86	18
19	18,99	0,66	18,99	0,75	18,98	0,83	18,98	0,91	19
20	19,99	0,70	19,98	0,79	19,98	0,87	19,98	0,96	20
21	20,99	0,73	20,98	0,82	20,98	0,92	20,98	1,01	21
22	21,99	0,77	21,98	0,86	21,98	0,96	21,97	1,06	22
23	22,99	0,80	22,98	0,90	22,98	1,00	22,97	1,10	23
24	23,99	0,84	23,98	0,94	23,98	1,05	23,97	1,15	24
25	24,98	0,87	24,98	0,98	24,98	1,09	24,97	1,20	25
26	25,98	0,91	25,98	1,02	25,98	1,13	25,97	1,25	26
27	26,98	0,94	26,98	1,06	26,97	1,18	26,97	1,30	27
28	27,98	0,98	27,98	1,10	27,97	1,22	27,97	1,34	28
29	28,98	1,01	28,98	1,14	28,97	1,26	28,97	1,39	29
30	29,98	1,05	29,98	1,18	29,97	1,31	29,97	1,44	30
31	30,98	1,08	30,98	1,22	30,97	1,35	30,96	1,49	31
32	31,98	1,12	31,98	1,26	31,97	1,40	31,96	1,54	32
33	32,98	1,15	32,97	1,30	32,97	1,44	32,96	1,58	33
34	33,98	1,19	33,97	1,33	33,97	1,48	33,96	1,63	34
35	34,98	1,22	34,97	1,37	34,97	1,53	34,96	1,68	35
36	35,98	1,26	35,97	1,41	35,97	1,57	35,96	1,73	36
37	36,98	1,29	36,97	1,45	36,96	1,61	36,96	1,78	37
38	37,98	1,33	37,97	1,49	37,96	1,66	37,96	1,82	38
39	38,98	1,36	38,97	1,53	38,96	1,70	38,96	1,87	39
40	39,98	1,40	39,97	1,57	39,96	1,75	39,95	1,92	40
41	40,98	1,43	40,97	1,61	40,96	1,77	40,95	1,97	41
42	41,97	1,47	41,97	1,65	41,96	1,83	41,95	2,02	42
43	42,97	1,50	42,97	1,69	42,96	1,88	42,95	2,06	43
44	43,97	1,54	43,97	1,73	43,96	1,92	43,95	2,11	44
45	44,97	1,57	44,97	1,77	44,96	1,96	44,95	2,16	45
46	45,97	1,61	45,96	1,81	45,96	2,01	45,95	2,21	46
47	46,97	1,64	46,96	1,85	46,96	2,05	46,95	2,25	47
48	47,97	1,68	47,96	1,88	47,95	2,09	47,95	2,30	48
49	48,97	1,71	48,96	1,92	48,95	2,14	48,94	3,35	49
50	49,97	1,74	49,96	1,96	49,95	2,18	49,94	2,40	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	88 Deg.		87¾ Deg.		87½ Deg.		87¼ Deg.		

Dist.	2 Deg. Lat.	2 Deg. Dep.	2¼ Deg. Lat.	2¼ Deg. Dep.	2½ Deg. Lat.	2½ Deg. Dep.	2¾ Deg. Lat.	2¾ Deg. Dep.	Dist.
51	50,97	1,78	50,96	2,00	50,95	2,22	50,94	2,45	51
52	51,97	1,81	51,96	2,04	51,95	2,27	51,94	2,50	52
53	52,97	1,85	52,96	2,08	52,95	2,31	52,94	2,54	53
54	53,97	1,88	53,96	2,12	53,95	2,36	53,94	2,59	54
55	54,97	1,92	54,96	2,16	54,95	2,40	54,94	2,64	55
56	55,97	1,95	55,96	2,20	55,95	2,44	55,94	2,69	56
57	56,97	1,99	56,96	2,24	56,95	2,49	56,93	2,73	57
58	57,96	2,02	57,96	2,28	57,94	2,53	57,93	2,78	58
59	58,96	2,06	58,95	2,32	58,94	2,57	58,93	2,83	59
60	59,96	2,09	59,95	2,36	59,94	2,62	59,93	2,88	60
61	60,96	2,13	60,95	2,39	60,94	2,66	60,93	2,93	61
62	61,96	2,16	61,95	2,43	61,94	2,70	61,93	2,97	62
63	62,96	2,20	62,95	2,47	62,94	2,75	62,93	3,02	63
64	63,96	2,23	63,95	2,51	63,94	2,79	63,93	3,07	64
65	64,96	2,27	64,95	2,55	64,94	2,84	64,93	3,12	65
66	65,96	2,30	65,95	2,59	65,94	2,88	65,92	3,17	66
67	66,96	2,34	66,95	2,63	66,94	2,92	66,92	3,21	67
68	67,96	2,37	67,95	2,67	67,94	2,97	67,92	3,26	68
69	68,96	2,41	68,95	2,71	68,93	3,01	68,92	3,31	69
70	69,96	2,44	69,95	2,75	69,93	3,05	69,92	3,36	70
71	70,96	2,48	70,95	2,79	70,93	3,10	70,92	3,41	71
72	71,96	2,51	71,94	2,83	71,93	3,14	71,92	3,45	72
73	72,96	2,55	72,94	2,87	72,93	3,18	72,92	3,50	73
74	73,95	2,58	73,94	2,91	73,93	3,23	73,91	3,55	74
75	74,95	2,62	74,94	2,94	74,93	3,27	74,91	3,60	75
76	75,95	2,65	75,94	2,98	75,93	3,31	75,91	3,65	76
77	76,95	2,69	76,94	3,02	76,93	3,36	76,91	3,70	77
78	77,95	2,72	77,94	3,06	77,93	3,40	77,91	3,74	78
79	78,95	2,76	78,94	3,10	78,92	3,45	78,91	3,79	79
80	79,95	2,79	79,94	3,14	79,92	3,49	79,91	3,84	80
81	80,95	2,83	80,94	3,18	80,92	3,53	80,91	3,89	81
82	81,95	2,86	81,94	3,22	81,92	3,58	81,91	3,93	82
83	82,95	2,90	82,94	3,26	82,92	3,62	82,90	3,98	83
84	83,95	2,93	83,94	3,30	83,92	3,66	83,90	4,03	84
85	84,95	2,97	84,93	3,34	84,92	3,71	84,90	4,08	85
86	85,95	3,00	85,93	3,38	85,92	3,75	85,90	4,13	86
87	86,95	3,04	86,93	3,42	86,92	3,79	86,90	4,17	87
88	87,95	3,07	87,93	3,45	87,92	3,84	87,90	4,22	88
89	88,95	3,11	88,93	3,49	88,92	3,88	88,90	4,27	89
90	89,95	3,14	89,93	3,53	89,91	3,93	89,90	4,32	90
91	90,95	3,18	90,93	3,57	90,91	3,97	90,90	4,37	91
92	91,94	3,21	91,93	3,61	91,91	4,01	91,89	4,41	92
93	92,94	3,25	92,93	3,65	92,91	4,06	92,89	4,46	93
94	93,94	3,28	93,93	3,69	93,91	4,10	93,89	4,51	94
95	94,94	3,32	94,93	3,73	94,91	4,14	94,89	4,56	95
96	95,94	3,35	95,93	3,77	95,91	4,19	95,89	4,61	96
97	96,94	3,39	96,93	3,81	96,91	4,23	96,89	4,65	97
98	97,94	3,42	97,92	3,85	97,91	4,27	97,89	4,70	98
99	98,94	3,46	98,92	3,89	98,91	4,32	98,89	4,75	99
100	99,94	3,49	99,92	3,93	99,91	4,36	99,88	4,80	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	88 Deg.		87¾ Deg.		87½ Deg.		87¼ Deg.		

Dist.	3 Deg. Lat.	3 Deg. Dep.	3¼ Deg. Lat.	3¼ Deg. Dep.	3½ Deg. Lat.	3½ Deg. Dep.	3¾ Deg. Lat.	3¾ Deg. Dep.	Dist.
1	1,00	0,05	1,00	0,06	1,00	0,06	1,00	0,06	1
2	2,00	0,10	2,00	0,11	2,00	0,12	2,00	0,13	2
3	3,00	0,16	3,00	0,17	2,99	0,18	2,99	0,20	3
4	3,99	0,21	3,99	0,23	3,99	0,24	3,99	0,26	4
5	4,99	0,26	4,99	0,28	4,99	0,31	4,99	0,33	5
6	5,99	0,31	5,99	0,34	5,99	0,37	5,99	0,39	6
7	6,99	0,37	6,99	0,40	6,99	0,43	6,99	0,46	7
8	7,99	0,42	7,99	0,45	7,99	0,49	7,98	0,52	8
9	8,99	0,47	8,99	0,51	8,98	0,55	8,98	0,59	9
10	9,99	0,52	9,98	0,57	9,98	0,61	9,98	0,65	10
11	10,98	0,58	10,98	0,62	10,98	0,67	10,98	0,72	11
12	11,98	0,63	11,98	0,68	11,98	0,73	11,97	0,78	12
13	12,98	0,68	12,98	0,73	12,98	0,79	12,97	0,85	13
14	13,98	0,73	13,98	0,79	13,97	0,85	13,97	0,92	14
15	14,98	0,79	14,98	0,85	14,97	0,92	14,97	0,98	15
16	15,98	0,84	15,97	0,91	15,97	0,98	15,97	1,05	16
17	16,98	0,89	16,97	0,96	16,97	1,04	16,96	1,11	17
18	17,98	0,94	17,97	1,02	17,97	1,10	17,96	1,18	18
19	18,98	0,99	18,97	1,08	18,96	1,16	18,96	1,24	19
20	19,97	1,05	19,97	1,13	19,96	1,22	19,96	1,31	20
21	20,97	1,10	20,97	1,19	20,96	1,28	20,96	1,37	21
22	21,97	1,15	21,96	1,25	21,96	1,34	21,95	1,44	22
23	22,97	1,20	22,96	1,30	22,96	1,40	22,95	1,50	23
24	23,97	1,26	23,96	1,36	23,96	1,47	23,95	1,57	24
25	24,97	1,31	24,96	1,42	24,95	1,53	24,95	1,64	25
26	25,96	1,36	25,96	1,47	25,95	1,59	25,94	1,70	26
27	26,96	1,41	26,96	1,53	26,95	1,65	26,94	1,77	27
28	27,96	1,47	27,95	1,59	27,95	1,71	27,94	1,83	28
29	28,96	1,52	28,95	1,64	28,95	1,77	28,94	1,90	29
30	29,96	1,57	29,95	1,70	29,94	1,83	29,94	1,96	30
31	30,96	1,62	30,95	1,76	30,94	1,89	30,93	2,03	31
32	31,96	1,67	31,95	1,81	31,94	1,95	31,93	2,09	32
33	32,95	1,73	32,95	1,87	32,94	2,01	32,93	2,16	33
34	33,95	1,78	33,95	1,93	33,94	2,08	33,93	2,22	34
35	34,95	1,83	34,94	1,98	34,93	2,14	34,92	2,29	35
36	35,95	1,88	35,94	2,04	35,93	2,20	35,92	2,35	36
37	36,95	1,94	36,94	2,10	36,93	2,26	36,92	2,42	37
38	37,95	1,99	37,94	2,15	37,93	2,32	37,92	2,49	38
39	38,95	2,04	38,94	2,21	38,93	2,38	38,92	2,55	39
40	39,95	2,09	39,94	2,27	39,93	2,44	39,91	2,62	40
41	40,94	2,15	40,93	2,32	40,92	2,50	40,91	2,68	41
42	41,94	2,20	41,93	2,38	41,92	2,56	41,91	2,75	42
43	42,94	2,25	42,93	2,44	42,92	2,63	42,91	2,81	43
44	43,94	2,30	43,93	2,49	43,92	2,69	43,91	2,88	44
45	44,94	2,36	44,93	2,55	44,92	2,75	44,90	2,94	45
46	45,94	2,41	45,93	2,61	45,91	2,81	45,90	3,01	46
47	46,94	2,46	46,92	2,66	46,91	2,87	46,90	3,07	47
48	47,93	2,51	47,92	2,72	47,91	2,93	47,90	3,14	48
49	48,93	2,56	48,92	2,78	48,91	2,99	48,90	3,20	46
50	49,93	2,62	49,92	2,83	49,91	3,05	49,89	3,27	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	87 Deg.		86¾ Deg.		86½ Deg.		86¼ Deg.		

Dist.	3 Deg. Lat.	3 Deg. Dep.	3¼ Deg. Lat.	3¼ Deg. Dep.	3½ Deg. Lat.	3½ Deg. Dep.	3¾ Deg. Lat.	3¾ Deg. Dep.	Dist.
51	50,93	2,67	50,92	2,89	50,90	3,11	50,89	3,34	51
52	51,93	2,72	51,92	2,95	51,90	3,17	51,89	3,40	52
53	52,93	2,77	52,91	3,00	52,90	3,24	52,89	3,47	53
54	53,93	2,83	53,91	3,06	53,90	3,30	53,88	3,53	54
55	54,92	2,88	54,91	3,12	54,90	3,36	54,88	3,60	55
56	55,92	2,93	55,91	3,17	55,90	3,42	55,88	3,66	56
57	56,92	2,98	56,91	3,23	56,89	3,48	56,88	3,73	57
58	57,92	3,04	57,91	3,29	57,89	3,54	57,88	3,79	58
59	58,92	3,09	58,91	3,34	58,89	3,60	58,87	3,86	59
60	59,92	3,14	59,90	3,40	59,89	3,66	59,87	3,92	60
61	60,92	3,19	60,90	3,46	60,89	3,72	60,87	3,99	61
62	61,92	3,24	61,90	3,51	61,88	3,79	61,87	4,05	62
63	62,91	3,30	62,90	3,57	62,88	3,85	62,87	4,12	63
64	63,91	3,35	63,90	3,63	63,88	3,91	63,86	4,19	64
65	64,91	3,40	64,90	3,69	64,88	3,97	64,86	4,25	65
66	65,91	3,45	65,89	3,74	65,88	4,03	65,86	4,32	66
67	66,91	3,51	66,89	3,80	66,88	4,09	66,86	4,38	67
68	67,91	3,56	67,89	3,86	67,87	4,15	67,85	4,45	68
69	68,91	3,61	68,89	3,91	68,87	4,21	68,85	4,51	69
70	69,91	3,66	69,89	3,97	69,87	4,27	69,85	4,58	70
71	70,90	3,72	70,89	4,03	70,87	4,33	70,85	4,64	71
72	71,90	3,77	71,88	4,08	71,87	4,40	71,85	4,71	72
73	72,90	3,82	72,88	4,14	72,86	4,46	72,84	4,77	73
74	73,90	3,87	73,88	4,20	73,86	4,52	73,84	4,84	74
75	74,90	3,93	74,88	4,25	74,86	4,58	74,84	4,91	75
76	75,90	3,98	75,88	4,31	75,86	4,64	75,84	4,97	76
77	76,89	4,03	76,88	4,37	76,86	4,70	76,84	5,04	77
78	77,89	4,08	77,87	4,42	77,85	4,76	77,83	5,10	78
79	78,89	4,13	78,87	4,48	78,85	4,82	78,83	5,17	79
80	79,89	4,19	79,87	4,54	79,85	4,88	79,83	5,23	80
81	80,89	4,24	80,87	4,59	80,85	4,94	80,83	5,30	81
82	81,89	4,29	81,87	4,65	81,85	5,01	81,82	5,36	82
83	82,89	4,34	82,8[illegible]	4,71	82,85	5,07	82,82	5,43	83
84	83,89	4,40	83,86	4,76	83,84	5,13	83,82	5,49	84
85	84,88	4,45	84,86	4,82	84,84	5,19	84,82	5,56	85
86	85,88	4,50	85,86	4,88	85,84	5,25	85,82	5,62	86
87	86,88	4,55	86,86	4,93	86,84	5,31	86,81	5,69	87
88	87,88	4,61	87,86	4,99	87,84	5,37	87,81	5,76	88
89	88,88	4,66	88,86	5,05	88,83	5,43	88,81	5,82	89
90	89,88	4,71	89,86	5,10	89,83	5,49	89,81	5,89	90
91	90,88	4,76	90,85	5,16	90,83	5,56	90,81	5,95	91
92	91,87	4,81	91,85	5,22	91,83	5,62	91,80	6,02	92
93	92,87	4,87	92,85	5,27	92,83	5,68	92,80	6,08	93
94	93,87	4,92	93,85	5,33	93,82	5,74	93,80	6,15	94
95	94,87	4,97	94,85	5,39	94,82	5,80	94,80	6,21	95
96	95,87	5,02	95,85	5,44	95,82	5,86	95,79	6,28	96
97	96,87	5,08	96,84	5,50	96,82	5,92	96,79	6,34	97
98	97,87	5,13	97,84	5,56	97,82	5,98	97,79	6,41	98
99	98,86	5,18	98,84	5,61	98,82	6,04	98,79	6,47	99
100	99,86	5,23	99,84	5,67	99,81	6,10	99,79	6,54	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	87 Deg.		86¾ Deg.		86½ Deg.		87¼ Deg.		

Dist.	4 Deg.		4¼ Deg.		4½ Deg.		4¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	1,00	0,07	1,00	0,07	1,00	0,08	1,00	0,08	1
2	2,00	0,14	1,99	0,15	1,99	0,16	1,99	0,17	2
3	2,99	0,21	2,99	0,22	2,99	0,24	2,99	0,25	3
4	3,99	0,28	3,99	0,30	3,99	0,31	3,98	0,33	4
5	4,99	0,35	4,99	0,37	4,98	0,39	4,98	0,41	5
6	5,99	0,42	5,98	0,44	5,98	0,47	5,98	0,50	6
7	6,98	0,49	6,98	0,52	6,98	0,55	6,97	0,58	7
8	7,98	0,56	7,98	0,59	7,98	0,63	7,97	0,66	8
9	8,98	0,63	8,98	0,67	8,97	0,71	8,97	0,75	9
10	9,98	0,70	9,97	0,74	9,97	0,78	9,97	0,83	10
11	10,97	0,77	10,97	0,82	10,97	0,86	10,96	0,91	11
12	11,97	0,84	11,97	0,89	11,96	0,94	11,96	0,99	12
13	12,97	0,91	12,96	0,96	12,96	1,02	12,96	1,08	13
14	13,97	0,98	13,96	1,04	13,96	1,10	13,95	1,16	14
15	14,96	1,05	14,96	1,11	14,95	1,18	14,95	1,24	15
16	15,96	1,12	15,96	1,19	15,95	1,26	15,95	1,32	16
17	16,96	1,19	16,95	1,26	16,95	1,33	16,94	1,41	17
18	17,96	1,26	17,95	1,33	17,94	1,41	17,94	1,49	18
19	18,95	1,33	18,95	1,40	18,94	1,49	18,93	1,57	19
20	19,95	1,40	19,95	1,48	19,94	1,57	19,93	1,66	20
21	20,95	1,46	20,94	1,56	20,94	1,65	20,93	1,74	21
22	21,95	1,53	21,94	1,63	21,93	1,73	21,92	1,82	22
23	22,94	1,60	22,94	1,70	22,93	1,80	22,92	1,90	23
24	23,94	1,67	23,93	1,78	23,93	1,88	23,92	1,99	24
25	24,94	1,74	24,93	1,85	24,92	1,96	24,91	2,07	25
26	25,94	1,81	25,93	1,93	25,92	2,04	25,91	2,15	26
27	26,93	1,88	26,93	2,00	26,92	2,12	26,91	2,24	27
28	27,93	1,95	27,92	2,08	27,91	2,20	27,90	2,32	28
29	28,93	2,02	28,92	2,15	28,91	2,28	28,90	2,40	29
30	29,93	2,09	29,92	2,22	29,91	2,35	29,90	2,48	30
31	30,92	2,16	30,91	2,30	30,90	2,43	30,89	2,57	31
32	31,92	2,23	31,91	2,37	31,90	2,51	31,89	2,65	32
33	32,92	2,30	32,91	2,45	32,90	2,59	32,89	2,73	33
34	33,92	2,37	33,91	2,52	33,90	2,67	33,88	2,82	34
35	34,91	2,44	34,90	2,59	34,89	2,75	34,88	2,90	35
36	35,91	2,51	35,90	2,67	35,89	2,82	35,88	2,98	36
37	36,91	2,58	36,90	2,74	36,89	2,90	36,87	3,06	37
38	37,91	2,65	37,90	2,82	37,88	2,98	37,87	3,15	38
39	38,90	2,72	38,89	2,89	38,88	3,06	38,87	3,23	39
40	39,90	2,79	39,89	2,96	39,88	3,14	39,86	3,31	40
41	40,90	2,86	40,89	3,04	40,87	3,22	40,86	3,40	41
42	41,90	2,93	41,88	3,11	41,87	3,30	41,86	3,48	42
43	42,90	3,00	42,88	3,19	42,87	3,37	42,85	3,56	43
44	43,89	3,07	43,88	3,26	43,86	3,45	43,85	3,64	44
45	44,89	3,14	44,88	3,33	44,86	3,53	44,85	3,73	45
46	45,89	3,21	45,87	3,41	45,86	3,61	45,84	3,81	46
47	46,89	3,28	46,87	3,48	46,86	3,69	46,84	3,89	47
48	47,88	3,35	47,87	3,56	47,85	3,77	47,84	3,97	48
49	48,88	3,42	48,87	3,63	48,85	3,84	48,83	4,06	49
50	49,88	3,49	49,86	3,71	49,85	3,92	49,83	4,14	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	86 Deg.		85¾ Deg.		85½ Deg.		85¼ Deg.		

Dist.	4 Deg.		4¼ Deg.		4½ Deg.		4¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep	
51	50,88	3,56	50,86	3,78	50,84	4,00	50,82	4,22	51
52	51,87	3,63	51,86	3,85	51,84	4,08	51,82	4,31	52
53	52,87	3,70	52,85	3,93	52,84	4,16	52,82	4,39	53
54	53,87	3,77	53,85	4,00	53,83	4,24	53,81	4,47	54
55	54,87	3,84	54,85	4,08	54,83	4,32	54,81	4,55	55
56	55,86	3,91	55,85	4,15	55,83	4,39	55,81	4,64	56
57	56,86	3,98	56,84	4,22	56,82	4,47	56,80	4,72	57
58	57,86	4,05	57,84	4,30	57,82	4,55	57,80	4,80	58
59	58,86	4,12	58,84	4,37	58,82	4,63	58,80	4,89	59
60	59,85	4,19	59,84	4,45	59,82	4,71	59,79	4,97	60
61	60,85	4,26	60,83	4,52	60,81	4,79	60,79	5,05	61
62	61,85	4,32	61,83	4,59	61,81	4,86	61,79	5,13	62
63	62,85	4,39	62,83	4,67	62,81	4,94	62,78	5,22	63
64	63,84	4,46	63,82	4,74	63,80	5,02	63,78	5,30	64
65	64,84	4,53	64,82	4,82	64,80	5,10	64,78	5,38	65
66	65,84	4,60	65,82	4,89	65,80	5,18	65,77	5,47	66
67	66,84	4,67	66,82	4,97	66,79	5,26	66,77	5,55	67
68	67,83	4,74	67,81	5,04	67,79	5,34	67,77	5,63	68
69	68,83	4,81	68,81	5,11	68,79	5,41	68,76	5,71	69
70	69,83	4,88	69,81	5,19	69,78	5,49	69,76	5,80	70
71	70,83	4,95	70,80	5,26	70,78	5,57	70,76	5,88	71
72	71,82	5,02	71,80	5,34	71,78	5,65	71,75	5,96	72
73	72,82	5,09	72,80	5,41	72,77	5,73	72,75	6,04	73
74	73,82	5,16	73,80	5,48	73,77	5,81	73,75	6,13	74
75	74,82	5,23	74,79	5,56	74,77	5,88	74,74	6,21	75
76	75,81	5,30	75,79	5,63	75,77	5,96	75,74	6,29	76
77	76,81	5,37	76,79	5,71	76,76	6,04	76,74	6,38	77
78	77,81	5,44	77,79	5,78	77,76	6,12	77,73	6,46	78
79	78,81	5,51	78,78	5,85	78,76	6,20	78,73	6,54	79
80	79,81	5,58	79,78	5,93	79,75	6,28	79,73	6,62	80
81	80,80	5,65	80,78	6,00	80,75	6,36	80,72	6,71	81
82	81,80	5,72	81,78	6,08	81,75	6,43	81,72	6,79	82
83	82,80	5,79	82,77	6,15	82,74	6,51	82,71	6,87	83
84	83,80	5,86	83,77	6,23	83,74	6,59	83,71	6,96	84
85	84,79	5,93	84,77	6,30	84,74	6,67	84,71	7,04	85
86	85,79	6,00	85,76	6,37	85,73	6,75	85,70	7,12	86
87	86,79	6,07	86,76	6,45	86,73	6,83	86,70	7,20	87
88	87,79	6,14	87,76	6,52	87,73	6,90	87,70	7,29	88
89	88,78	6,21	88,76	6,60	88,73	6,98	88,70	7,37	89
90	89,78	6,28	89,75	6,67	89,72	7,06	89,69	7,45	90
91	90,78	6,35	90,75	6,74	90,72	7,14	90,69	7,54	91
92	91,78	6,42	91,75	6,82	91,72	7,22	91,68	7,62	92
93	92,77	6,49	92,74	6,89	92,71	7,30	92,68	7,70	93
94	93,77	6,56	93,74	6,97	93,71	7,38	93,68	7,78	94
95	94,77	6,63	94,74	7,04	94,71	7,45	94,67	7,87	95
96	95,77	6,70	95,74	7,11	95,70	7,53	95,67	7,95	96
97	96,76	6,77	96,73	7,19	96,70	7,61	96,67	8,03	97
98	97,76	6,84	97,73	7,26	97,70	7,69	97,66	8,12	98
99	98,76	6,91	98,73	7,34	98,69	7,77	98,66	8,20	99
100	99,76	6,98	99,73	7,41	99,69	7,85	99,66	8,28	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	86 Deg.		85¾ Deg.		85½ Deg.		85¼ Deg.		

Dist.	5 Deg.		5¼ Deg.		5½ Deg.		5¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	1,00	0,09	1,00	0,09	1,00	0,10	0,99	0,10	1
2	1,99	0,17	1,99	0,18	1,99	0,19	1,99	0,20	2
3	2,99	0,26	2,99	0,27	2,99	0,29	2,98	0,30	3
4	3,98	0,35	3,98	0,37	3,98	0,38	3,98	0,40	4
5	4,98	0,44	4,98	0,46	4,98	0,48	4,97	0,50	5
6	5,98	0,52	5,97	0,55	5,97	0,58	5,97	0,60	6
7	6,97	0,61	6,97	0,64	6,97	0,67	6,96	0,70	7
8	7,97	0,70	7,97	0,73	7,96	0,76	7,96	0,80	8
9	8,97	0,78	8,96	0,82	8,96	0,86	8,95	0,90	9
10	9,96	0,87	9,96	0,92	9,95	0,96	9,95	1,00	10
11	10,96	0,96	10,95	1,01	10,95	1,05	10,94	1,10	11
12	11,95	1,05	11,95	1,10	11,94	1,15	11,94	1,20	12
13	12,95	1,13	12,95	1,19	12,94	1,25	12,93	1,30	13
14	13,95	1,22	13,94	1,28	13,94	1,34	13,93	1,40	14
15	14,94	1,31	14,94	1,37	14,93	1,44	14,92	1,50	15
16	15,94	1,39	15,93	1,46	15,93	1,53	15,92	1,60	16
17	16,94	1,48	16,93	1,56	16,92	1,63	16,91	1,70	17
18	17,93	1,57	17,92	1,65	17,92	1,73	17,91	1,80	18
19	18,93	1,66	18,92	1,74	18,91	1,82	18,90	1,90	19
20	19,92	1,74	19,92	1,83	19,91	1,92	19,90	2,00	20
21	20,92	1,83	20,91	1,92	20,90	2,01	20,89	2,10	21
22	21,92	1,92	21,91	2,01	21,90	2,11	21,89	2,20	22
23	22,91	2,00	22,90	2,10	22,89	2,20	22,88	2,30	23
24	23,91	2,09	23,90	2,20	23,89	2,30	23,88	2,40	24
25	24,90	2,18	24,90	2,29	24,88	2,40	24,87	2,50	25
26	25,90	2,27	25,89	2,38	25,88	2,49	25,87	2,60	26
27	26,90	2,35	26,89	2,47	26,88	2,59	26,86	2,71	27
28	27,89	2,44	27,88	2,56	27,87	2,68	27,86	2,81	28
29	28,89	2,53	28,88	2,65	28,87	2,78	28,85	2,91	29
30	29,89	2,61	29,87	2,75	29,86	2,88	29,85	3,01	30
31	30,88	2,70	30,87	2,84	30,86	2,97	30,84	3,11	31
32	31,88	2,79	31,87	2,93	31,85	3,07	31,84	3,21	32
33	32,87	2,88	32,86	3,02	32,85	3,16	32,83	3,31	33
34	33,87	2,96	33,86	3,11	33,84	3,26	33,83	3,41	34
35	34,87	3,05	34,85	3,20	34,84	3,35	34,82	3,51	35
36	35,86	3,14	35,85	3,29	35,83	3,45	35,82	3,61	36
37	36,86	3,22	36,84	3,39	36,83	3,55	36,81	3,71	37
38	37,86	3,31	37,84	3,48	37,83	3,64	37,81	3,81	38
39	38,85	3,40	38,84	3,57	38,82	3,74	38,80	3,91	39
40	39,85	3,49	39,83	3,66	39,82	3,83	39,80	4,01	40
41	40,84	3,57	40,83	3,75	40,81	3,93	40,79	4,11	41
42	41,84	3,66	41,82	3,84	41,81	4,03	41,79	4,21	42
43	42,84	3,75	42,82	3,93	42,80	4,12	42,78	4,31	43
44	43,83	3,83	43,82	4,03	43,80	4,22	43,78	4,41	44
45	44,83	3,92	44,81	4,12	44,79	4,31	44,77	4,51	45
46	45,82	4,01	45,81	4,21	45,79	4,41	45,77	4,61	46
47	46,82	4,10	46,80	4,30	46,78	4,50	46,76	4,71	47
48	47,82	4,18	47,80	4,39	47,78	4,60	47,76	4,81	48
49	48,81	4,27	48,79	4,48	48,77	4,70	48,75	4,91	49
50	49,81	4,36	49,79	4,58	49,77	4,79	49,75	5,01	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	85 Deg.		84¾ Deg.		84½ Deg.		84¼ Deg.		

Dist.	5 Deg. Lat.	5 Deg. Dep.	5¼ Deg. Lat.	5¼ Deg. Dep.	5½ Deg. Lat.	5½ Deg. Dep.	5¾ Deg. Lat.	5¾ Deg. Dep.	Dist.
51	50,81	4,44	50,79	4,67	50,77	4,89	50,74	5,11	51
52	51,80	4,53	51,78	4,76	51,76	4,98	51,74	5,21	52
53	52,80	4,62	52,78	4,85	52,76	5,08	52,73	5,31	53
54	53,79	4,71	53,77	4,94	53,75	5,18	53,73	5,41	54
55	54,79	4,79	54,77	5,03	54,75	5,27	54,72	5,51	55
56	55,79	4,88	55,77	5,12	55,74	5,37	55,72	5,61	56
57	56,78	4,97	56,76	5,22	56,74	5,46	56,71	5,71	57
58	57,78	5,06	57,76	5,31	57,73	5,56	57,71	5,81	58
59	58,78	5,14	58,75	5,40	58,73	5,65	58,70	5,91	59
60	59,77	5,23	59,75	5,49	59,72	5,75	59,70	6,01	60
61	60,77	5,32	60,74	5,58	60,72	5,85	60,69	6,11	61
62	61,76	5,40	61,74	5,67	61,71	5,94	61,69	6,21	62
63	62,76	5,49	62,74	5,76	62,71	6,04	62,68	6,31	63
64	63,76	5,58	63,73	5,86	63,71	6,13	63,68	6,41	64
65	64,75	5,67	64,73	5,95	64,70	6,23	64,67	6,51	65
66	65,75	5,75	65,72	6,04	65,70	6,33	65,67	6,61	66
67	66,75	5,84	66,72	6,13	66,69	6,42	66,66	6,71	67
68	67,74	5,93	67,71	6,22	67,69	6,52	67,66	6,81	68
69	68,74	6,01	68,71	6,31	68,68	6,61	68,65	6,91	69
70	69,73	6,10	69,71	6,41	69,68	6,71	69,65	7,01	70
71	70,73	6,19	70,70	6,50	70,67	6,81	70,64	7,11	71
72	71,73	6,28	71,70	6,59	71,67	6,90	71,64	7,21	72
73	72,72	6,36	72,69	6,68	72,66	7,00	72,63	7,31	73
74	73,72	6,45	73,69	6,77	73,66	7,09	73,63	7,41	74
75	74,71	6,54	74,69	6,86	74,65	7,19	74,62	7,51	75
76	75,71	6,62	75,68	6,95	75,65	7,28	75,62	7,61	76
77	76,71	6,71	76,68	7,05	76,65	7,38	76,61	7,71	77
78	77,70	6,80	77,67	7,14	77,64	7,48	77,61	7,81	78
79	78,70	6,89	78,67	7,23	78,64	7,57	78,60	7,91	79
80	79,70	6,97	79,66	7,32	79,63	7,67	79,60	8,02	80
81	80,69	7,06	80,66	7,41	80,63	7,76	80,59	8,12	81
82	81,69	7,15	81,66	7,50	81,62	7,86	81,59	8,22	82
83	82,68	7,23	82,65	7,59	82,62	7,96	82,58	8,32	83
84	83,68	7,32	83,65	7,69	83,61	8,05	83,58	8,42	84
85	84,68	7,41	84,64	7,78	84,61	8,15	84,57	8,52	85
86	85,67	7,50	85,64	7,87	85,60	8,24	85,57	8,62	86
87	86,67	7,58	86,64	7,96	86,60	8,34	86,56	8,72	87
88	87,67	7,67	87,63	8,05	87,59	8,44	87,56	8,82	88
89	88,66	7,76	88,63	8,14	88,59	8,53	88,55	8,92	89
90	89,66	7,84	89,62	8,24	89,59	8,63	89,55	9,02	90
91	90,65	7,93	90,62	8,33	90,58	8,72	90,54	9,12	91
92	91,65	8,02	91,61	8,42	91,58	8,82	91,54	9,22	92
93	92,65	8,11	92,61	8,51	92,57	8,91	92,53	9,32	93
94	93,64	8,19	93,61	8,60	93,57	9,01	93,53	9,42	94
95	94,64	8,28	94,60	8,69	94,56	9,11	94,52	9,52	95
96	95,63	8,37	95,60	8,78	95,56	9,20	95,52	9,62	96
97	96,63	8,45	96,59	8,88	96,55	9,30	96,51	9,72	97
98	97,63	8,54	97,59	8,97	97,55	9,39	97,51	9,82	98
99	98,62	8,63	98,59	9,06	98,54	9,49	98,50	9,92	99
100	99,62	8,72	99,58	9,15	99,54	9,58	99,50	10,02	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	85 Deg.		84¾ Deg.		84½ Deg.		84¼ Deg.		

Dist.	6 Deg. Lat.	6 Deg. Dep.	6¼ Deg. Lat.	6¼ Deg. Dep.	6½ Deg. Lat.	6½ Deg. Dep.	6¾ Deg. Lat.	6¾ Deg. Dep.	Dist.
1	0,99	0,10	0,99	0,11	0,99	0,11	0,99	0,12	1
2	1,99	0,21	1,99	0,22	1,99	0,23	1,99	0,24	2
3	2,98	0,31	2,98	0,33	2,98	0,34	2,98	0,35	3
4	3,98	0,41	3,98	0,44	3,97	0,45	3,97	0,47	4
5	4,97	0,52	4,97	0,54	4,97	0,57	4,97	0,59	5
6	5,97	0,63	5,96	0,65	5,96	0,68	5,96	0,71	6
7	6,96	0,73	6,96	0,76	6,96	0,79	6,95	0,82	7
8	7,96	0,84	7,95	0,87	7,95	0,91	7,94	0,94	8
9	8,95	0,94	8,95	0,98	8,94	1,02	8,94	1,06	9
10	9,95	1,05	9,94	1,09	9,94	1,13	9,93	1,18	10
11	10,94	1,15	10,93	1,20	10,93	1,25	10,92	1,29	11
12	11,93	1,25	11,93	1,31	11,92	1,36	11,92	1,41	12
13	12,93	1,36	12,92	1,42	12,92	1,47	12,91	1,53	13
14	13,92	1,46	13,92	1,52	13,91	1,59	13,90	1,65	14
15	14,92	1,57	14,91	1,63	14,90	1,70	14,90	1,76	15
16	15,91	1,67	15,90	1,74	15,90	1,81	15,89	1,88	16
17	16,91	1,78	16,90	1,85	16,89	1,92	16,88	2,00	17
18	17,90	1,88	17,89	1,96	17,88	2,04	17,87	2,12	18
19	18,90	1,99	18,89	2,07	18,88	2,15	18,87	2,23	19
20	19,89	2,09	19,88	2,18	19,87	2,26	19,86	2,35	20
21	20,88	2,20	20,88	2,29	20,87	2,38	20,85	2,47	21
22	21,88	2,30	21,87	2,40	21,86	2,49	21,85	2,59	22
23	22,87	2,40	22,86	2,50	22,85	2,60	22,84	2,70	23
24	23,87	2,51	23,86	2,61	23,85	2,72	23,83	2,82	24
25	24,86	2,61	24,85	2,72	24,84	2,83	24,83	2,94	25
26	25,86	2,72	25,85	2,83	25,83	2,94	25,82	3,06	26
27	26,85	2,82	26,84	2,94	26,83	3,06	26,81	3,17	27
28	27,85	2,93	27,83	3,05	27,82	3,17	27,81	3,29	28
29	28,84	3,03	28,83	3,16	28,81	3,28	28,80	3,41	29
30	29,84	3,14	29,82	3,27	29,81	3,40	29,79	3,53	30
31	30,83	3,24	30,82	3,37	30,80	3,51	30,79	3,64	31
32	31,82	3,34	31,81	3,48	31,79	3,62	31,78	3,76	32
33	32,82	3,45	32,80	3,59	32,79	3,74	32,77	3,88	33
34	33,81	3,55	33,80	3,70	33,78	3,85	33,76	4,00	34
35	34,81	3,66	34,79	3,81	34,78	3,96	34,76	4,11	35
36	35,80	3,76	35,79	3,92	35,77	4,08	35,75	4,23	36
37	36,80	3,87	36,78	4,03	36,76	4,19	36,75	4,35	37
38	37,79	3,97	37,77	4,14	37,76	4,30	37,74	4,47	38
39	38,79	4,08	38,77	4,25	38,75	4,41	38,73	4,58	39
40	39,78	4,18	39,76	4,35	39,74	4,53	39,72	4,70	40
41	40,78	4,29	40,76	4,46	40,74	4,64	40,72	4,82	41
42	41,77	4,39	41,75	4,57	41,73	4,76	41,71	4,94	42
43	42,76	4,49	42,74	4,68	42,72	4,87	42,70	5,05	43
44	43,76	4,60	43,74	4,79	43,72	4,98	43,70	5,17	44
45	44,75	4,70	44,73	4,90	44,71	5,09	44,69	5,29	45
46	45,75	4,81	45,73	5,01	45,70	5,21	45,68	5,41	46
47	46,74	4,91	46,72	5,12	46,70	5,32	46,67	5,52	47
48	47,74	5,02	47,71	5,23	47,69	5,43	47,67	5,64	48
49	48,73	5,12	48,71	5,34	48,69	5,55	48,66	5,76	49
50	49,73	5,23	49,70	5,44	49,68	5,66	49,65	5,88	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	84 Deg.		83¾ Deg.		83½ Deg.		83¼ Deg.		

Dist.	6 Deg. Lat.	6 Deg. Dep.	6¼ Deg. Lat.	6¼ Deg. Dep.	6½ Deg. Lat.	6½ Deg. Dep.	6¾ Deg. Lat.	6¾ Deg. Dep.	Dist.
51	50,72	5,33	50,70	5,55	50,67	5,77	50,65	5,99	51
52	51,72	5,44	51,69	5,66	51,67	5,89	51,64	6,11	52
53	52,71	5,54	52,68	5,77	52,66	6,00	52,63	6,23	53
54	53,70	5,64	53,68	5,88	53,65	6,11	53,63	6,35	54
55	54,70	5,75	54,67	5,99	54,65	6,23	54,62	6,46	55
56	55,69	5,85	55,67	6,10	55,64	6,34	55,61	6,58	56
57	56,69	5,96	56,66	6,21	56,63	6,45	56,60	6,70	57
58	57,68	6,06	57,66	6,31	57,63	6,57	57,60	6,82	58
59	58,68	6,17	58,66	6,42	58,62	6,68	58,59	6,93	59
60	59,67	6,27	59,64	6,53	59,61	6,79	59,58	7,05	60
61	60,67	6,38	60,64	6,64	60,62	6,91	60,58	7,17	61
62	61,66	6,48	61,63	6,75	61,60	7,02	61,57	7,29	62
63	62,65	6,59	62,63	6,86	62,60	7,13	62,56	7,40	63
64	63,65	6,69	63,62	6,97	63,59	7,25	63,56	7,52	64
65	64,64	6,79	64,61	7,08	64,58	7,36	64,55	7,64	65
66	65,64	6,90	65,61	7,19	65,58	7,47	65,54	7,76	66
67	66,63	7,00	66,60	7,29	66,57	7,58	66,54	7,88	67
68	67,63	7,11	67,60	7,40	67,56	7,70	67,53	7,99	68
69	68,62	7,21	68,59	7,51	68,56	7,81	68,52	8,11	69
70	69,62	7,32	69,58	7,62	69,55	7,92	69,51	8,23	70
71	70,61	7,42	70,56	7,73	70,54	8,04	70,51	8,35	71
72	71,61	7,53	71,57	7,84	71,54	8,15	71,50	8,46	72
73	72,60	7,63	72,57	7,95	72,53	8,26	72,49	8,58	73
74	73,59	7,74	73,56	8,06	73,52	8,38	73,49	8,70	74
75	74,59	7,84	74,55	8,17	74,52	8,49	74,48	8,82	75
76	75,58	7,94	75,55	8,27	75,51	8,60	75,47	8,93	76
77	76,58	8,05	76,54	8,38	76,51	8,72	76,47	9,05	77
78	77,57	8,15	77,54	8,49	77,50	8,83	77,46	9,17	78
79	78,57	8,26	78,53	8,60	78,49	8,94	78,45	9,29	79
80	79,56	8,36	79,53	8,71	79,49	9,06	79,45	9,40	80
81	80,56	8,47	80,52	8,82	80,48	9,17	80,44	9,52	81
82	81,55	8,57	81,51	8,93	81,48	9,28	81,43	9,64	82
83	82,55	3,68	82,51	9,04	82,47	9,40	82,42	9,76	83
84	83,54	8,78	83,50	9,14	83,46	9,51	83,42	9,87	84
85	84,53	8,88	84,50	9,25	84,45	9,62	84,41	9,99	85
86	85,53	8,99	85,49	9,36	85,45	9,74	85,40	10,11	86
87	86,52	9,09	86,48	9,47	86,44	9,85	86,40	10,23	87
88	87,52	9,20	87,48	9,58	87,43	9,96	87,39	10,34	88
89	88,51	9,30	88,47	9,69	88,43	10,08	88,38	10,46	89
90	89,51	9,41	89,47	9,80	89,42	10,19	89,38	10,58	90
91	90,50	9,51	90,46	9,91	90,42	10,30	90,37	10,70	91
92	91,50	9,62	91,45	10,02	91,41	10,41	91,36	10,81	92
93	92,49	9,72	92,45	10,12	92,40	10,53	92,36	10,93	93
94	93,49	9,83	93,44	10,23	93,40	10,64	93,35	11,05	94
95	94,48	9,93	94,44	10,34	94,39	10,75	94,34	11,17	95
96	95,47	10,03	95,43	10,45	95,38	10,87	95,33	11,28	96
97	96,47	10,14	96,42	10,56	96,38	10,98	96,33	11,40	97
98	97,46	10,24	97,42	19,67	97,37	11,09	97,32	11,52	98
99	98,46	10,35	98,41	10,78	98,36	11,21	98,31	11,64	99
100	99,45	10,45	99,41	10,89	99,36	11,32	99,31	11,75	100
Dist.	84 Deg. Dep.	84 Deg. Lat.	83¾ Deg. Dep.	83¾ Deg. Lat.	83½ Deg. Dep.	83½ Deg. Lat.	83¼ Deg. Dep.	83¼ Deg. Lat.	Dist.

Dist.	7 Deg.		7¼ Deg.		7½ Deg.		7¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,99	0,12	0,99	0,13	0,99	0,13	0,99	0,13	1
2	1,99	0,24	1,98	0,25	1,98	0,26	1,98	0,27	2
3	2,98	0,37	2,98	0,38	2,97	0,39	2,97	0,40	3
4	3,97	0,49	3,97	0,50	3,97	0,52	3,96	0,54	4
5	4,96	0,61	4,96	0,63	4,96	0,65	4,95	0,67	5
6	5,96	0,73	5,95	0,76	5,95	0,78	5,95	0,81	6
7	6,95	0,85	6,94	0,88	6,94	0,91	6,94	0,94	7
8	7,94	0,97	7,94	1,01	7,93	1,04	7,93	1,08	8
9	8,93	1,10	8,93	1,14	8,92	1,17	8,92	1,21	9
10	9,93	1,22	9,92	1,26	9,91	1,31	9,91	1,35	10
11	10,92	1,34	10,91	1,39	10,91	1,44	10,90	1,48	11
12	11,91	1,46	11,90	1,51	11,90	1,57	11,89	1,62	12
13	12,90	1,58	12,90	1,64	12,89	1,70	12,88	1,75	13
14	13,90	1,71	13,89	1,77	13,88	1,83	13,87	1,89	14
15	14,89	1,83	14,88	1,89	14,87	1,96	14,86	2,02	15
16	15,88	1,95	15,87	2,02	15,86	2,09	15,85	2,16	16
17	16,87	2,07	16,86	2,15	16,85	2,22	16,84	2,29	17
18	17,87	2,19	17,86	2,27	17,85	2,35	17,84	2,43	18
19	18,86	2,32	18,85	2,40	18,84	2,48	18,83	2,56	19
20	19,85	2,44	19,84	2,52	19,83	2,61	19,82	2,70	20
21	20,84	2,56	20,83	2,65	20,82	2,74	20,81	2,83	21
22	21,84	2,68	21,82	2,78	21,81	2,87	21,80	2,97	22
23	22,83	2,80	22,82	2,90	22,80	3,00	22,79	3,10	23
24	23,82	2,92	23.81	3,03	23,79	3,13	23,78	3,24	24
25	24,81	3,05	24,80	3,15	24,79	3,26	24,77	3,37	25
26	25,81	3,17	25,79	3,28	25,78	3,39	25,76	3,51	26
27	26,80	3,29	26,78	3,41	26,77	3,52	26,75	3,64	27
28	27,79	3,41	27,78	3,53	27,76	3,65	27,74	3,78	28
29	28,78	3,53	28,77	3,66	28,75	3,79	28,74	3,91	29
30	29,78	3,66	29,76	3.79	29,74	3,92	29,73	4,05	30
31	30,77	3,78	30,75	3,91	30,73	4,05	30,72	4,18	31
32	31,76	3,90	31,74	4,04	31,73	4,18	31,71	4,32	32
33	32,75	4,02	32,74	4,16	32,72	4,31	32,70	4,45	33
34	33,75	4,14	33,73	4,29	33,71	4,44	33,69	4,58	34
35	34,74	4,27	34,72	4,42	34,70	4,57	34,68	4,72	35
36	35,73	4,39	35,71	4,54	35,69	4,70	35,67	4,85	36
37	36,72	4,51	36,70	4,67	36,68	4,83	36,66	4,99	37
38	37,72	4,63	37,70	4,80	37,67	4,96	37,65	5,12	38
39	38,71	4,75	38,69	4,92	38,67	5,09	38,64	5,26	39
40	39,70	4,87	39,68	5,05	39,66	5,22	39,63	5,39	40
41	40,70	5,00	40,67	5,17	40,65	5,35	40,63	5,53	41
42	41,69	5,12	41,66	5,30	41,64	5,48	41,62	5,66	42
43	42,68	5,24	42,66	5,43	42,63	5,61	42,61	5,80	43
44	43,67	5,36	43,65	5,55	43,62	5,74	43,60	5,93	44
45	44,67	5,48	44,64	5,68	44,62	5,87	44,59	6,07	45
46	45,66	5,61	45,63	5,81	45,61	6,00	45,58	6,20	46
47	46,65	5,73	46,62	5,93	46,60	6,13	46,57	6,34	47
48	47,64	5,85	47,62	6,06	47,59	6,27	47,56	6,47	48
49	48,63	5,97	48,61	6,18	48,58	6,40	48,55	6,61	49
50	49,63	6,09	49,60	6,31	49,57	6,53	49,54	6,74	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	83 Deg.		82¾ Deg.		82½ Deg.		82¼ Deg.		

Dist.	7 Deg. Lat.	7 Deg. Dep.	7¼ Deg. Lat.	7¼ Deg. Dep.	7½ Deg. Lat.	7½ Deg. Dep.	7¾ Deg. Lat.	7¾ Deg. Dep.	Dist.
51	50,62	6,22	50,59	6,44	50,56	6,66	50,53	6,88	51
52	51,61	6,34	51,58	6,56	51,56	6,79	51,53	7,01	52
53	52,60	6,46	52,58	6,69	52,55	6,92	52,52	7,15	53
54	53,60	6,58	53,57	6,81	53,54	7,05	53,51	7,28	54
55	54,59	6,70	54,56	6,94	54,53	7,18	54,50	7,42	55
56	55,58	6,82	55,55	7,07	55,52	7,31	55,49	7,55	56
57	56,58	6,95	56,54	7,19	56,51	7,44	56,48	7,69	57
58	57,57	7,07	57,54	7,32	57,50	7,57	57,47	7,82	58
59	58,56	7,19	58,53	7,45	58,50	7,70	58,46	7,96	59
60	59,55	7,31	59,52	7,57	59,49	7,83	59,45	8,09	60
61	60,55	7,43	60,51	7,70	60,48	7,96	60,44	8,23	61
62	61,54	7,56	61,50	7,82	61,47	8,09	61,43	8,36	62
63	62,53	7,68	62,50	7,95	62,46	8,22	62,42	8,50	63
64	63,52	7,80	63,49	8,08	63,45	8,35	63,42	8,63	64
65	64,52	7,92	64,48	8,20	64,44	8,48	64,41	8,77	65
66	65,51	8,04	65,47	8,33	65,44	8,61	65,40	8,90	66
67	66,50	8,17	66,46	8,46	66,43	8,75	66,39	9,04	67
68	67,49	8,29	67,46	8,58	67,42	8,88	67,38	9,17	68
69	68,49	8,41	68,45	8,71	68,41	9,01	68,37	9,30	69
70	69,48	8,53	69,44	8,83	69,40	9,14	69,36	9,44	70
71	70,47	8,65	70,43	8,96	70,39	9,27	70,35	9,57	71
72	71,46	8,77	71,42	9,09	71,38	9,40	71,34	9,71	72
73	72,46	8,90	72,42	9,21	72,38	9,53	72,33	9,84	73
74	73,45	9,02	73,41	9,34	73,37	9,66	73,32	9,98	74
75	74,44	9,14	74,40	9,46	74,36	9,79	74,31	10,11	75
76	75,43	9,26	75,39	9,59	75,35	9,92	75,31	10,25	76
77	76,43	9,38	76,38	9,72	76,34	10,05	76,30	10,38	77
78	77,42	9,51	77,38	9,84	77,33	10,18	77,29	10,52	78
79	78,41	9,63	78,37	9,97	78,32	10,31	78,28	10,65	79
80	79,40	9,75	79,36	10,10	79,32	10,44	79,27	10,79	80
81	80,40	9,87	80,35	10,22	80,31	10,57	80,26	10,92	81
82	81,39	9,99	81,34	10,35	81,30	10,70	81,25	11,06	82
83	82,38	10,12	82,34	10,47	82,29	10,83	82,24	11,19	83
84	83,37	10,24	83,33	10,60	83,28	10,96	83,23	11,33	84
85	84,37	10,36	84,32	10,73	84,27	11,09	84,22	11,46	85
86	85,36	10,48	85,31	10,85	85,26	11,23	85,21	11,60	86
87	86,35	10,60	86,30	10,98	86,26	11,36	86,21	11,73	87
88	87,34	10,72	87,30	11,11	87,25	11,49	87,20	11,87	88
89	88,34	10,85	88,29	11,23	88,24	11,62	88,19	12,00	89
90	89,33	10,97	89,28	11,36	89,23	11,75	89,18	12,14	90
91	90,32	11,09	90,27	11,48	90,22	11,88	90,17	12,27	91
92	91,31	11,21	91,26	11,61	91,21	12,01	91,16	12,41	92
93	92,31	11,33	92,26	11,74	92,20	12,14	92,15	12,54	93
94	93,30	11,46	93,25	11,86	93,20	12,27	93,14	12,68	94
95	94,29	11,58	94,24	11,99	94,19	12,40	94,13	12,81	95
96	95,28	11,70	95,23	12,12	95,18	12,53	95,12	12,95	96
97	96,28	11,82	96,22	12,24	96,17	12,66	96,11	13,08	97
98	97,27	11,94	97,22	12,37	97,16	12,79	97,10	13,22	98
99	98,26	12,07	98,21	12,49	98,15	12,92	98,10	13,35	99
100	99,25	12,19	99,20	12,62	99,14	13,05	99,09	13,49	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	83 Deg.		82¾ Deg.		82½ Deg.		82¼ Deg.		

Dist.	8 Deg. Lat.	8 Deg. Dep.	8¼ Deg. Lat.	8¼ Deg. Dep.	8½ Deg. Lat.	8½ Deg. Dep.	8¾ Deg. Lat.	8¾ Deg. Dep.	Dist.
1	0,99	0,14	0,99	0,14	0,99	0,15	0,99	0,15	1
2	1,98	0,28	1,98	0,29	1,98	0,30	1,98	0,30	2
3	2,97	0,42	2,97	0,43	2,97	0,44	2,97	0,46	3
4	3,96	0,56	3,96	0,57	3,96	0,59	3,95	0,61	4
5	4,95	0,70	4,95	0,72	4,95	0,74	4,94	0,76	5
6	5,94	0,84	5,94	0,86	5,93	0,89	5,93	0,91	6
7	6,93	0,97	6,93	1,00	6,92	1,03	6,92	1,06	7
8	7,92	1,11	7,92	1,15	7,91	1,18	7,91	1,22	8
9	8,91	1,25	8,91	1,29	8,90	1,33	8,90	1,37	9
10	9,90	1,39	9,90	1,43	9,89	1,48	9,88	1,52	10
11	10,89	1,53	10,89	1,58	10,88	1,63	10,87	1,67	11
12	11,88	1,67	11,88	1,72	11,87	1,77	11,86	1,83	12
13	12,87	1,81	12,87	1,87	12,86	1,92	12,85	1,98	13
14	13,86	1,95	13,86	2,01	13,85	2,07	13,84	2,13	14
15	14,85	2,04	14,85	2,15	14,84	2,22	14,83	2,28	15
16	15,84	2,23	15,84	2,30	15,82	2,36	15,81	2,43	16
17	16,83	2,32	16,83	2,44	16,81	2,51	16,80	2,59	17
18	17,82	2,51	17,81	2,58	17,80	2,66	17,79	2,74	18
19	18,82	2,64	18,80	2,73	18,79	2,81	18,78	2,89	19
20	19,81	2,78	19,79	2,87	19,78	2,96	19,77	3,04	20
21	20,80	2,92	20,78	3,01	20,77	3,10	20,76	3,19	21
22	21,79	3,06	21,77	3,16	21,76	3,25	21,74	3,35	22
23	22,78	3,20	22,76	3,30	22,75	3,40	22,73	3,50	23
24	23,77	3,34	23,75	3,44	23,74	3,55	23,72	3,65	24
25	24,76	3,48	24,74	3,59	24,73	3,70	24,71	3,80	25
26	25,75	3,62	25,73	3,73	25,71	3,84	25,70	3,96	26
27	26,74	3,76	26,72	3,87	26,70	3,99	26,69	4,11	27
28	27,73	3,90	27,71	4,02	27,69	4,14	27,67	4,26	28
29	28,72	4,04	28,70	4,16	28,68	4,29	28,66	4,41	29
30	29,71	4,18	29,69	4,30	29,67	4,43	29,65	4,56	30
31	30,70	4,31	30,68	4,45	30,66	4,58	30,64	4,72	31
32	31,69	4,45	31,67	4,59	31,65	4,73	31,63	4,87	32
33	32,68	4,59	32,66	4,74	32,64	4,88	32,62	5,02	33
34	33,67	4,73	33,65	4,88	33,63	5,03	33,60	5,17	34
35	34,66	4,87	34,64	5,02	34,62	5,17	34,59	5,32	35
36	35,65	5,01	35,63	5,17	35,60	5,32	35,58	5,48	36
37	36,64	5,15	36,62	5,31	36,59	5,47	36,57	5,63	37
38	37,63	5,29	37,61	5,45	37,58	5,62	37,56	5,78	38
39	38,62	5,43	38,60	5,60	38,57	5,76	38,55	5,93	39
40	39,61	5,57	39,59	5,74	39,56	5,91	39,53	6,08	40
41	40,60	5,71	40,58	5,88	40,55	6,06	40,52	6,24	41
42	41,59	5,85	41,57	6,03	41,54	6,21	41,51	6,39	42
43	42,58	5,98	42,56	6,17	42,53	6,36	42,50	6,54	43
44	43,57	6,12	43,54	6,31	43,52	6,50	43,49	6,69	44
45	44,56	6,26	44,53	6,46	44,51	6,65	44,48	6,85	45
46	45,55	6,40	45,52	6,60	45,49	6,80	45,46	7,00	46
47	46,54	6,54	46,51	6,74	46,48	6,95	46,45	7,15	47
48	47,53	6,68	47,50	6,89	47,47	7,09	47,44	7,30	48
49	48,52	6,82	48,49	7,03	48,46	7,24	48,43	7,45	49
50	49,51	6,96	49,48	7,17	49,45	7,39	49,42	7,61	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	82 Deg.		81¾ Deg.		81½ Deg.		81¼ Deg.		

Dist.	8 Deg. Lat.	8 Deg. Dep.	8¼ Deg. Lat.	8¼ Deg. Dep.	8½ Deg. Lat.	8½ Deg. Dep.	8¾ Deg. Lat.	8¾ Deg. Dep.	Dist.
51	50,50	7,10	50,47	7,32	50,44	7,54	50,41	7,76	51
52	51,49	7,24	51,46	7,46	51,43	7,69	51,39	7,91	52
53	52,48	7,38	52,45	7,61	52,42	7,83	52,38	8,06	53
54	53,47	7,52	53,44	7,75	53,41	7,98	53,37	8,21	54
55	54,46	7,65	54,43	7,89	54,40	8,13	54,36	8,37	55
56	55,46	7,79	55,42	8,04	55,38	8,28	55,35	8,52	56
57	56,45	7,93	56,41	8,18	56,37	8,43	56,34	8,67	57
58	57,44	8,07	57,40	8,32	57,36	8,57	57,32	8,82	58
59	58,43	8,21	58,39	8,47	58,35	8,72	58,31	8,98	59
60	59,42	8,35	59,38	8,61	59,34	8,87	59,30	9,13	60
61	60,41	8,49	60,37	8,75	60,33	9,02	60,29	9,28	61
62	61,40	8,63	61,36	8,90	61,32	9,16	61,28	9,43	62
63	62,39	8,77	62,35	9,04	62,31	9,31	62,27	9,58	63
64	63,38	8,91	63,34	9,18	63,30	9,46	63,26	9,74	64
65	64,37	9,05	64,33	9,33	64,29	9,61	64,24	9,89	65
66	65,36	9,19	65,32	9,47	65,28	9,76	65,23	10,04	66
67	66,35	9,32	66,31	9,61	66,26	9,90	66,22	10,19	67
68	67,34	9,46	67,30	9,76	67,25	10,05	67,21	10,34	68
69	68,33	9,60	68,29	9,90	68,24	10,20	68,20	10,50	69
70	69,32	9,74	69,28	10,04	69,23	10,35	69,19	10,65	70
71	70,31	9,88	70,27	10,19	70,22	10,49	70,17	10,80	71
72	71,30	10,02	71,25	10,33	71,21	10,64	71,16	10,95	72
73	72,29	10,16	72,24	10,47	72,20	10,79	72,15	11,10	73
74	73,28	10,30	73,23	10,62	73,19	10,94	73,14	11,26	74
75	74,27	10,44	74,22	10,76	74,18	11,09	74,13	11,41	75
76	75,26	10,58	75,21	10,91	75,17	11,23	75,12	11,56	76
77	76,25	10,72	76,20	11,05	76,15	11,38	76,10	11,71	77
78	77,24	10,86	77,19	11,19	77,14	11,53	77,09	11,87	78
79	78,23	10,99	78,18	11,34	78,13	11,68	78,08	12,02	79
80	79,22	11,13	79,17	11,48	79,12	11,82	79,07	12,17	80
81	80,21	11,27	80,16	11,62	80,11	11,97	80,06	12,32	81
82	81,20	11,41	81,15	11,77	81,10	12,12	81,05	12,47	82
83	82,19	11,55	82,14	11,91	82,09	12,27	82,03	12,63	83
84	83,18	11,69	83,13	12,05	83,08	12,42	83,02	12,78	84
85	84,17	11,83	84,12	12,20	84,07	12,56	84,01	12,93	85
86	85,16	11,97	85,11	12,34	85,06	12,71	85,00	13,08	86
87	86,15	12,11	86,10	12,48	86,04	12,86	85,99	13,23	87
88	87,14	12,25	87,09	12,63	87,03	13,01	86,98	13,39	88
89	88,13	12,39	88,08	12,77	88,02	13,16	87,96	13,54	89
90	89,12	12,53	89,07	12,91	89,01	13,30	88,95	13,69	90
91	90,11	12,66	90,06	13,06	90,00	13,45	89,94	13,84	91
92	91,10	12,80	91,05	13,20	90,99	13,60	90,93	14,00	92
93	92,09	12,94	92,04	13,34	91,98	13,75	91,92	14,15	93
94	93,09	13,08	93,03	13,49	92,97	13,89	92,91	14,30	94
95	94,08	13,22	94,02	13,63	93,96	14,04	93,89	14,45	95
96	95,07	13,36	95,01	13,78	94,95	14,19	94,88	14,60	96
97	96,06	13,50	96,00	13,92	95,93	14,34	95,87	14,76	97
98	97,05	13,64	96,99	14,06	96,92	14,49	96,86	14,91	98
99	98,04	13,78	97,98	14,21	97,91	14,63	97,85	15,06	99
100	99,03	13,92	98,97	14,35	98,90	14,78	98,84	15,21	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	82 Deg.		81¾ Deg.		81½ Deg.		81¼ Deg.		

Dist.	9 Deg. Lat.	9 Deg. Dep.	9¼ Deg. Lat.	9¼ Deg. Dep.	9½ Deg. Lat.	9½ Deg. Dep.	9¾ Deg. Lat.	9¾ Deg. Dep.	Dist.
1	0,99	0,16	0,99	0,16	0,99	0,17	0,99	0,17	1
2	1,98	0,31	1,97	0,32	1,97	0,33	1,97	0,34	2
3	2,96	0,47	2,96	0,48	2,96	0,50	2,96	0,51	3
4	3,95	0,63	3,95	0,64	3,95	0,66	3,94	0,68	4
5	4,94	0,78	4,93	0,80	4,93	0,83	4,93	0,85	5
6	5,93	0,94	5,92	0,96	5,92	0,99	5,91	1,02	6
7	6,91	1,10	6,91	1,13	6,90	1,16	6,90	1,19	7
8	7,90	1,25	7,90	1,29	7,89	1,32	7,88	1,35	8
9	8,89	1,41	8,88	1,45	8,88	1,49	8,87	1,52	9
10	9,88	1,56	9,87	1,61	9,86	1,65	9,86	1,69	10
11	10,86	1,72	10,86	1,77	10,85	1,82	10,84	1,86	11
12	11,85	1,88	11,84	1,93	11,84	1,98	11,83	2,03	12
13	12,84	2,03	12,83	2,09	12,82	2,15	12,81	2,20	13
14	13,83	2,19	13,82	2,25	13,81	2,31	13,80	2,37	14
15	14,82	2,35	14,80	2,41	14,79	2,48	14,78	2,54	15
16	15,80	2,50	15,79	2,57	15,78	2,64	15,77	2,71	16
17	16,79	2,66	16,78	2,73	16,77	2,81	16,75	2,88	17
18	17,78	2,82	17,77	2,89	17,75	2,97	17,74	3,05	18
19	18,77	2,97	18,75	3,05	18,74	3,14	18,73	3,22	19
20	19,75	3,13	19,74	3,21	19,73	3,30	19,71	3,39	20
21	20,74	3,29	20,73	3,38	20,71	3,47	20,70	3,56	21
22	21,73	3,44	21,71	3,54	21,70	3,63	21,68	3,73	22
23	22,72	3,60	22,70	3,70	22,68	3,80	22,67	3,90	23
24	23,70	3,75	23,69	3,86	23,67	3,96	23,65	4,06	24
25	24,69	3,91	24,67	4,02	24,66	4,13	24,64	4,23	25
26	25,68	4,07	25,66	4,18	25,64	4,29	25,62	4,40	26
27	26,67	4,22	26,65	4,34	26,63	4,46	26,61	4,57	27
28	27,66	4,38	27,64	4,50	27,62	4,62	27,60	4,74	28
29	28,64	4,54	28,62	4,66	28,60	4,79	28,58	4,91	29
30	29,63	4,69	29,61	4,82	29,59	4,95	29,57	5,08	30
31	30,62	4,85	30,60	4,98	30,57	5,12	30,55	5,25	31
32	31,61	5,01	31,58	5,14	31,56	5,28	31,54	5,42	32
33	32,59	5,16	32,57	5,30	32,55	5,45	32,52	5,59	33
34	33,58	5,32	33,56	5,47	33,53	5,61	33,51	5,76	34
35	34,57	5,48	34,54	5,63	34,52	5,78	34,49	5,93	35
36	35,56	5,63	35,53	5,79	35,51	5,94	35,48	6,10	36
37	36,54	5,79	36,52	5,95	36,49	6,11	36,47	6,27	37
38	37,53	5,94	37,51	6,11	37,48	6,27	37,45	6,44	38
39	38,52	6,10	38,49	6,27	38,47	6,44	38,44	6,60	39
40	39,51	6,26	39,48	6,43	39,45	6,60	39,42	6,77	40
41	40,50	6,41	40,47	6,59	40,44	6,77	40,41	6,94	41
42	41,48	6,57	41,45	6,75	41,42	6,92	41,39	7,11	42
43	42,47	6,73	42,44	6,91	42,41	7,10	42,38	7,28	43
44	43,46	6,88	43,43	7,07	43,40	7,26	43,36	7,45	44
45	44,45	7,04	44,41	7,23	44,38	7,43	44,35	7,62	45
46	45,43	7,20	45,40	7,39	45,37	7,59	45,34	7,79	46
47	46,42	7,35	46,39	7,55	46,36	7,76	46,32	7,96	47
48	47,41	7,51	47,38	7,72	47,34	7,92	47,31	8,13	48
49	48,40	7,67	48,36	7,88	48,33	8,09	48,29	8,30	49
50	49,38	7,82	49,35	8,04	49,32	8,25	49,28	8,47	50
Dist.	Dep	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	81 Deg.		80¾ Deg.		80½ Deg.		80¼ Deg.		

Dist.	9 Deg. Lat.	9 Deg. Dep.	9¼ Deg. Lat.	9¼ Deg. Dep.	9½ Deg. Lat.	9½ Deg. Dep.	9¾ Deg. Lat.	9¾ Deg. Dep.	Dist.
51	50,37	7,98	50,34	8,20	50,30	8,42	50,26	8,64	51
52	51,36	8,13	51,32	8,36	51,29	8,58	51,25	8,81	52
53	52,35	8,29	52,31	8,52	52,27	8,75	52,23	8,98	53
54	53,34	8,45	53,30	8,68	53,26	8,91	53,22	9,14	54
55	54,32	8,60	54,28	8,84	54,25	9,08	54,21	9,31	55
56	55,31	8,76	55,27	9,00	55,23	9,24	55,19	9,48	56
57	56,30	8,92	56,26	9,16	56,22	9,41	56,18	9,65	57
58	57,29	9,07	57,25	9,32	57,20	9,57	57,16	9,82	58
59	58,27	9,23	58,23	9,48	58,19	9,74	58,15	9,99	59
60	59,26	9,39	59,22	9,64	59,18	9,90	59,13	10,16	60
61	60,25	9,54	60,21	9,81	60,16	10,07	60,12	10,33	61
62	61,24	9,70	61,19	9,97	61,15	10,23	61,10	10,50	62
63	62,22	9,86	62,18	10,13	62,14	10,40	62,09	10,67	63
64	63,21	10,01	63,17	10,29	63,12	10,56	63,08	10,84	64
65	64,20	10,17	64,15	10,45	64,11	10,73	64,06	11,01	65
66	65,19	10,32	65,14	10,61	65,09	10,89	65,05	11,18	66
67	66,18	10,48	66,13	10,77	66,08	11,06	66,03	11,35	67
68	67,16	10,64	67,12	10,93	67,07	11,22	67,02	11,52	68
69	68,15	10,79	68,10	11,09	68,05	11,39	68,00	11,69	69
70	69,14	10,95	69,09	11,25	69,04	11,55	68,99	11,85	70
71	70,13	11,11	70,08	11,41	70,03	11,72	69,97	12,02	71
72	71,11	11,26	71,06	11,57	71,01	11,88	70,96	12,19	72
73	72,10	11,42	72,05	11,73	72,00	12,05	71,95	12,36	73
74	73,09	11,58	73,04	11,89	72,99	12,21	72,93	12,53	74
75	74,08	11,73	74,02	12,06	73,97	12,38	73,92	12,70	75
76	75,06	11,89	75,01	12,22	74,96	12,54	74,90	12,87	76
77	76,05	12,05	76,00	12,38	75,94	12,71	75,89	13,04	77
78	77,04	12,20	76,99	12,54	76,93	12,87	76,87	13,21	78
79	78,03	12,36	77,97	12,70	77,92	13,04	77,86	13,38	79
80	79,02	12,51	78,96	12,86	78,90	13,20	78,84	13,55	80
81	80,00	12,67	79,95	13,02	79,89	13,37	79,83	13,72	81
82	80,99	12,83	80,93	13,18	80,88	13,53	80,82	13,89	82
83	81,98	12,98	81,92	13,34	81,86	13,70	81,80	14,06	83
84	82,97	13,14	82,91	13,50	82,85	13,86	82,79	14,23	84
85	83,95	13,30	83,89	13,66	83,83	14,03	83,77	14,39	85
86	84,94	13,45	84,88	13,82	84,82	14,19	84,76	14,56	86
87	85,93	13,61	85,87	13,98	85,81	14,36	85,74	14,73	87
88	86,92	13,77	86,86	14,15	86,79	14,52	86,73	14,90	88
89	87,90	13,92	87,84	14,31	87,78	14,69	87,71	15,07	89
90	88,89	14,08	88,83	14,47	88,77	14,85	88,70	15,24	90
91	89,88	14,24	89,82	14,63	89,75	15,02	89,69	15,41	91
92	90,87	14,39	90,80	14,79	90,74	15,18	90,67	15,58	92
93	91,86	14,55	91,79	14,95	91,72	15,35	91,66	15,75	93
94	92,84	14,70	92,78	15,11	92,71	15,51	92,64	15,92	94
95	93,83	14,86	93,76	15,27	93,70	15,68	93,63	16,09	95
96	94,82	15,02	94,75	15,43	94,68	15,84	94,61	16,26	96
97	95,81	15,17	95,74	15,59	95,67	16,01	95,60	16,43	97
98	96,79	15,33	96,73	15,75	96,66	16,17	96,58	16,60	98
99	97,78	15,49	97,71	15,91	97,64	16,34	97,57	16,77	99
100	98,77	15,64	98,70	16,07	98,63	16,50	98,56	16,93	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	81 Deg.		80¾ Deg.		80½ Deg.		80¼ Deg.		

Dist.	10 Deg. Lat.	10 Deg. Dep.	10¼ Deg. Lat.	10¼ Deg. Dep.	10½ Deg. Lat.	10½ Deg. Dep.	10¾ Deg. Lat.	10¾ Deg. Dep.	Dist.
1	0,98	0,17	0,98	0,18	0,98	0,18	0,98	0,19	1
2	1,97	0,35	1,97	0,36	1,97	0,36	1,96	0,37	2
3	2,95	0,52	2,95	0,53	2,95	0,55	2,95	0,56	3
4	3,94	0,69	3,94	0,71	3,93	0,73	3,93	0,75	4
5	4,92	0,87	4,92	0,89	4,92	0,91	4,91	0,93	5
6	5,91	1,04	5,90	1,07	5,90	1,09	5,89	1,12	6
7	6,89	1,22	6,89	1,25	6,88	1,28	6,88	1,31	7
8	7,88	1,39	7,87	1,42	7,87	1,46	7,86	1,49	8
9	8,86	1,56	8,86	1,60	8,85	1,64	8,84	1,68	9
10	9,85	1,74	9,84	1,78	9,83	1,82	9,82	1,87	10
11	10,83	1,91	10,82	1,96	10,82	2,00	10,81	2,05	11
12	11,82	2,08	11,81	2,14	11,80	2,19	11,79	2,24	12
13	12,80	2,26	12,79	2,31	12,78	2,37	12,77	2,42	13
14	13,79	2,43	13,78	2,49	13,77	2,55	13,75	2,61	14
15	14,77	2,60	14,76	2,67	14,75	2,73	14,74	2,80	15
16	15,76	2,78	15,74	2,85	15,73	2,92	15,72	2,98	16
17	16,74	2,95	16,73	3,03	16,72	3,10	16,70	3,17	17
18	17,73	3,13	17,71	3,20	17,70	3,28	17,68	3,36	18
19	18,71	3,30	18,70	3,38	18,68	3,46	18,67	3,54	19
20	19,70	3,47	19,68	3,56	19,67	3,64	19,65	3,73	20
21	20,68	3,65	20,66	3,74	20,65	3,83	20,63	3,92	21
22	21,67	3,82	21,65	3,91	21,63	4,01	21,61	4,10	22
23	22,65	3,99	22,63	4,09	22,61	4,19	22,60	4,29	23
24	23,64	4,17	23,62	4,27	23,60	4,37	23,58	4,48	24
25	24,62	4,34	24,60	4,45	24,58	4,56	24,56	4,66	25
26	25,61	4,51	25,59	4,63	25,56	4,74	25,54	4,85	26
27	26,59	4,69	26,57	4,80	26,55	4,92	26,53	5,04	27
28	27,57	4,86	27,55	4,98	27,53	5,10	27,51	5,22	28
29	28,56	5,04	28,54	5,16	28,51	5,28	28,49	5,41	29
30	29 54	5,21	29,52	5,34	29,50	5,47	29,47	5,60	30
31	30,53	5,38	30,51	5,52	30,48	5,65	30,46	5,78	31
32	31,51	5,56	31,49	5,69	31,46	5,83	31,44	5,97	32
33	32,50	5,73	32,47	5,87	32,45	6,01	32,42	6,16	33
34	33,48	5,90	33,46	6,05	33,43	6,20	33,40	6,34	34
35	34,47	6,08	34,44	6,23	34,41	6,38	34,39	6,53	35
36	35,45	6,25	35,43	6,41	35,40	6,56	35,37	6,71	36
37	36,44	6,42	36,41	6,58	36,38	6,74	36,35	6,90	37
38	37,42	6,60	37,39	6,76	37,36	6,92	37,33	7,09	38
39	38,41	6,77	38,38	6,94	38,35	7,11	38,32	7,27	39
40	39,39	6,95	39,36	7,12	39,33	7,29	39,30	7,46	40
41	40,38	7,12	40,35	7,30	40,31	7,47	40,28	7,65	41
42	41,36	7,29	41,33	7,47	41,30	7,65	41,26	7,83	42
43	42,35	7,47	42,31	7,65	42,28	7,84	42,25	8,02	43
44	43,33	7,64	43,30	7,83	43,26	8,02	43,23	8,21	44
45	44,32	7,81	44,28	8,01	44,25	8,20	44,21	8,39	45
46	45,30	7,99	45,27	8,19	45,23	8,38	45,19	8,58	46
47	46,29	8,16	46,25	8,36	46,21	8,57	46,18	8,77	47
48	47,27	8,34	47,23	8,54	47,20	8,75	47,16	8,95	48
49	48,26	8,51	48,22	8,72	48,18	8,93	48,14	9,14	49
50	49,24	8,68	49,20	8,90	49,16	9,11	49,12	9,33	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	80 Deg.		79¾ Deg.		79½ Deg.		79¼ Deg.		

Dist.	10 Deg. Lat.	10 Deg. Dep.	10¼ Deg. Lat.	10¼ Deg. Dep.	10½ Deg. Lat.	10½ Deg. Dep.	10¾ Deg. Lat.	10¾ Deg. Dep.	Dist.
51	50,23	8,86	50,19	9,08	50,15	9,29	50,10	9,51	51
52	51,21	9,03	51,17	9,25	51,13	9,48	51,09	9,70	52
53	52,19	9,20	52,15	9,43	52,11	9,66	52,07	9,89	53
54	53,18	9,38	53,14	9,61	53,10	9,84	53,05	10,07	54
55	54,16	9,55	54,12	9,79	54,08	10,02	54,03	10,26	55
56	55,15	9,72	55,11	9,96	55,06	10,21	55,02	10,45	56
57	56,13	9,90	56,09	10,14	56,05	10,39	56,00	10,63	57
58	57,12	10,07	57,07	10,32	57,03	10,57	56,98	10,82	58
59	58,10	10,25	58,06	10,50	58,01	10,75	57,96	11,00	59
60	59,09	10,42	59,04	10,68	59,00	10,93	58,95	11,19	60
61	60,07	10,59	60,03	10,85	59,98	11,12	59,93	11,38	61
62	61,06	10,77	61,01	11,03	60,96	11,30	60,91	11,56	62
63	62,04	10,94	61,99	11,21	61,95	11,48	61,89	11,75	63
64	63,03	11,11	62,98	11,39	62,93	11,66	62,88	11,94	64
65	64,01	11,29	63,96	11,57	63,91	11,85	63,86	12,12	65
66	65,00	11,46	64,95	11,74	64,89	12,03	64,84	12,31	66
67	65,98	11,63	65,93	11,92	65,88	12,21	65,82	12,50	67
68	66,97	11,81	66,91	12,10	66,86	12,39	66,81	12,68	68
69	67,95	11,98	67,90	12,28	67,84	12,57	67,79	12,87	69
70	68,94	12,16	68,88	12,46	68,83	12,76	68,77	13,06	70
71	69,92	12,33	69,87	12,63	69,81	12,94	69,75	13,24	71
72	70,91	12,50	70,85	12,81	70,79	13,12	70,74	13,43	72
73	71,89	12,68	71,83	12,99	71,78	13,30	71,72	13,62	73
74	72,88	12,85	72,82	13,17	72,76	13,49	72,70	13,80	74
75	73,86	13,02	73,80	13,35	73,74	13,67	73,68	13,99	75
76	74,85	13,20	74,79	13,52	74,73	13,85	74,67	14,18	76
77	75,83	13,37	75,77	13,70	75,71	14,03	75,65	14,36	77
78	76,82	13,54	76,76	13,88	76,69	14,21	76,63	14,55	78
79	77,80	13,72	77,74	14,06	77,68	14,40	77,61	14,74	79
80	78.78	13.89	78,72	14,24	78,66	14,58	78,60	14,92	80
81	79,77	14,07	79,71	14,41	79,64	14,76	79,58	15,11	81
82	80,75	14,24	80,69	14,59	80,63	14,94	80,56	15,29	82
83	81,74	14,41	81,68	14,77	81,61	15,13	81,54	15,48	83
84	82,72	14,59	82,66	14,95	82,59	15,31	82,53	15,67	84
85	83.71	14,76	83,64	15,13	83,58	15,49	83,51	15,85	85
86	84,69	14,93	84,63	15,30	84,56	15,67	84,49	16,04	86
87	85,68	15,11	85,61	15,48	85,54	15,85	85,47	16,23	87
88	86,66	15,28	86,60	15,66	86,53	16,04	86,46	16,41	88
89	87,65	15,45	87,58	15,84	87,51	16,22	87,44	16,60	89
90	88,63	15.63	88,56	16,01	88,49	16,40	88,42	16,79	90
91	89,62	15,80	89,55	16,19	89,48	16,58	89,40	16,97	91
92	90,60	15,98	90,53	16,37	90,46	16,77	90,39	17,16	92
93	91,59	16,15	91,52	16,55	91,44	16,95	91,37	17,35	93
94	92,57	16,32	92,50	16,73	92,43	17,13	92,35	17,53	94
95	93,56	16,50	93,48	16,90	93,41	17,31	93,33	17,72	95
96	94,54	16,67	94,47	17,08	94,39	17,49	94,32	17,91	96
97	95,53	16,84	95,45	17,26	95,38	17,68	95,30	18,09	97
98	96,51	17,02	96,44	17,44	96,36	17,86	96,28	18,28	98
99	97,50	17,19	97,42	17,62	97,34	18,04	97,26	18,47	99
100	98,48	17,36	98,40	17,79	98,33	18,22	98,25	18,65	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	80 Deg.		79¾ Deg.		79½ Deg.		79¼ Deg.		

Dist.	11 Deg. Lat.	11 Deg. Dep.	11¼ Deg. Lat.	11¼ Deg. Dep.	11½ Deg. Lat.	11½ Deg. Dep.	11¾ Deg. Lat.	11¾ Deg. Dep.	Dist.
1	0,98	0,19	0,98	0,20	0,98	0,20	0,98	0,20	1
2	1,96	0,38	1,96	0,39	1,96	0,40	1,96	0,41	2
3	2,94	0,57	2,94	0,59	2,94	0,60	2,94	0,61	3
4	3,93	0,76	3,92	0,78	3,92	0,80	3,92	0,82	4
5	4,91	0,95	4,90	0,98	4,90	1,00	4,90	1,02	5
6	5,89	1,14	5,88	1,17	5,88	1,20	5,87	1,22	6
7	6,87	1,34	6,87	1,37	6,86	1,40	6,85	1,43	7
8	7,85	1,53	7,85	1,56	7,84	1,59	7,83	1,63	8
9	8,83	1,72	8,83	1,76	8,82	1,79	8,81	1,83	9
10	9,82	1,91	9,81	1,95	9,80	1,99	9,79	2,04	10
11	10,80	2,10	10,79	2,15	10,78	2,19	10,77	2,24	11
12	11,78	2,29	11,77	2,34	11,76	2,39	11,75	2,44	12
13	12,76	2,48	12,75	2,54	12,74	2,59	12,73	2,65	13
14	13,74	2,67	13,73	2,73	13,72	2,79	13,71	2,85	14
15	14,72	2,86	14,71	2,93	14,70	2,99	14,69	3,06	15
16	15,71	3,05	15,69	3,12	15,68	3,19	15,66	3,26	16
17	16,69	3,24	16,67	3,32	16,66	3,39	16,64	3,46	17
18	17,67	3,43	17,65	3,51	17,64	3,59	17,62	3,66	18
19	18,65	3,63	18,63	3,71	18,62	3,79	18,60	3,87	19
20	19,63	3,82	19,62	3,90	19,60	3,99	19,58	4,07	20
21	20,61	4,01	20,60	4,10	20,58	4,19	20,56	4,28	21
22	21,60	4,20	21,58	4,29	21,56	4,39	21,54	4,48	22
23	22,58	4,39	22,56	4,49	22,54	4,59	22,52	4,68	23
24	23,56	4,58	23,54	4,68	23,52	4,78	23,50	4,89	24
25	24,54	4,77	24,52	4,88	24,50	4,98	24,48	5,09	25
26	25,52	4,96	25,50	5,07	25,48	5,18	25,46	5,30	26
27	26,50	5,15	26,48	5,27	26,46	5,38	26,43	5,50	27
28	27,49	5,34	27,46	5,46	27,44	5,58	27,41	5,70	28
29	28,47	5,53	28,44	5,66	28,42	5,78	28,39	5,91	29
30	29,45	5,72	29,42	5,85	29,40	5,98	29,37	6,11	30
31	30,43	5,92	30,40	6,05	30,38	6,18	30,35	6,31	31
32	31,41	6,11	31,39	6,24	31,36	6,38	31,33	6,52	32
33	32,39	6,30	32,37	6,44	32,34	6,58	32,31	6,72	33
34	33,38	6,49	33,35	6,63	33,32	6,78	33,29	6,92	34
35	34,36	6,68	34,33	6,83	34,30	6,98	34,27	7,13	35
36	35,34	6,87	35,31	7,02	35,28	7,18	35,25	7,33	36
37	36,32	7,06	36,29	7,22	36,26	7,38	36,22	7,53	37
38	37,30	7,25	37,27	7,41	37,24	7,58	37,20	7,74	38
39	38,28	7,44	38,25	7,61	38,22	7,78	38,18	7,94	39
40	39,27	7,63	39,23	7,80	39,20	7,97	39,16	8,15	40
41	40,25	7,82	40,21	8,00	40,18	8,17	40,14	8,35	41
42	41,23	8,01	41,19	8,19	41,16	8,37	41,12	8,55	42
43	42,21	8,20	42,17	8,39	42,14	8,57	42,10	8,76	43
44	43,19	8,40	43,15	8,58	43,12	8,77	43,08	8,96	44
45	44,17	8,59	44,14	8,78	44,10	8,97	44,06	9,16	45
46	45,15	8,78	45,12	9,97	45,08	9,17	45,04	9,37	46
47	46,14	8,97	46,10	9,17	46,06	9,37	46,02	9,57	47
48	47,12	9,16	47,08	9,36	47,04	9,57	46,99	9,78	48
49	48,10	9,35	48,06	9,56	48,02	9,77	47,97	9,98	49
50	49,08	9,54	49,04	9,75	49,00	9,97	48,95	10,18	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	79 Deg.		78¾ Deg.		78½ Deg.		78¼ Deg.		

Dist.	11 Deg. Lat.	11 Deg. Dep.	11¼ Deg. Lat.	11¼ Deg. Dep.	11½ Deg. Lat.	11½ Deg. Dep.	11¾ Deg. Lat.	11¾ Deg. Dep.	Dist.
51	50,06	9,73	50,02	9,95	49,98	10,17	49,93	10,39	51
52	51,04	9,92	51,00	10,14	50,96	10,37	50,91	10,59	52
53	52,03	10,11	51,98	10,34	51,94	10,57	51,89	10,79	53
54	53,01	10,30	52,96	10,53	52,92	10,77	52,87	11,00	54
55	53,99	10,49	53,94	10,73	53,90	10,97	53,85	11,20	55
56	54,97	10,69	54,92	10,93	54,88	11,16	54,83	11,40	56
57	55,95	10,88	55,90	11,12	55,86	11,36	55,81	11,61	57
58	56,93	11,07	56,89	11,32	56,84	11,56	56,78	11,81	58
59	57,92	11,26	57,87	11,51	57,82	11,76	57,76	12,01	59
60	58,90	11,45	58,85	11,71	58,80	11,96	58,74	12,22	60
61	59,88	11,64	59,83	11,90	59,78	12,16	59,72	12,42	61
62	60,86	11,83	60,81	12,10	60,76	12,36	60,70	12,63	62
63	61,84	12,02	61,79	12,29	61,74	12,56	61,68	12,83	63
64	62,82	12,21	62,77	12,49	62,72	12,76	62,66	13,03	64
65	63,81	12,40	63,75	12,68	63,70	12,96	63,64	13,24	65
66	64,79	12,59	64,73	12,88	64,68	13,16	64,62	13,44	66
67	65,77	12,78	65,71	13,07	65,66	13,36	65,60	13,64	67
68	66,75	12,98	66,69	13,27	66,63	13,56	66,58	13,85	68
69	67,73	13,17	67,67	13,46	67,61	13,76	67,55	14,05	69
70	68,71	13,36	68,66	13,66	68,59	13,96	68,53	14,25	70
71	69,70	13,55	69,64	13,85	69,57	14,16	69,51	14,46	71
72	70,68	13,74	70,62	14,05	70,55	14,35	70,49	14,66	72
73	71,66	13,93	71,60	14,24	71,53	14,55	71,47	14,87	73
74	72,64	14,12	72,58	14,44	72,51	14,75	72,45	15,07	74
75	73,62	14,31	73,56	14,63	73,49	14,95	73,43	15,27	75
76	74,60	14,50	74,54	14,83	74,47	15,15	74,41	15,48	76
77	75,59	14,69	75,52	15,02	75,45	15,35	75,39	15,68	77
78	76,57	14,88	76,50	15,22	76,43	15,55	76,37	15,88	78
79	77,55	15,07	77,48	15,41	77,41	15,75	77,34	16,09	79
80	78,53	15,26	78,46	15,61	78,39	15,95	78,32	16,29	80
81	79,51	15,46	79,44	15,80	79,37	16,15	79,30	16,49	81
82	80,49	15,65	80,42	16,00	80,35	16,35	80,28	16,70	82
83	81,48	15,84	81,41	16,19	81,33	16,55	81,26	16,90	83
84	82,46	16,03	82,39	16,39	82,31	16,75	82,24	17,11	84
85	83,44	16,22	83,37	16,58	83,29	16,95	83,22	17,31	85
86	84,42	16,41	84,35	16,78	84,27	17,15	84,20	17,51	86
87	85,40	16,60	85,33	16,97	85,25	17,35	85,18	17,72	87
88	86,38	16,79	86,31	17,17	86,23	17,54	86,16	17,92	88
89	87,36	16,98	87,29	17,36	87,21	17,74	87,14	18,12	89
90	88,35	17,17	88,27	17,56	88,19	17,94	88,11	18,33	90
91	89,33	17,36	89,25	17,75	89,17	18,14	89,09	18,53	91
92	90,31	17,55	90,23	17,95	90,15	18,34	90,07	18,74	92
93	91,29	17,75	91,21	18,14	91,13	18,54	91,05	18,94	93
94	92,27	17,94	92,19	18,34	92,11	18,74	92,03	19,14	94
95	93,25	18,13	93,17	18,53	93,09	18,94	93,01	19,35	95
96	94,24	18,32	94,16	18,73	94,07	19,14	93,99	19,55	96
97	95,22	18,51	95,14	18,92	95,05	19,34	94,97	19,75	97
98	96,20	18,70	96,12	19,12	96,03	19,54	95,95	19,96	98
99	97,18	18,89	97,10	19,31	97,01	19,74	96,93	20,16	99
100	98,16	19,08	98,08	19,51	97,99	19,94	97,90	20,36	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	79 Deg.		78¾ Deg.		78½ Deg.		78¼ Deg.		

Dist.	12 Deg.		12¼ Deg.		12½ Deg.		12¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,98	0,21	0,98	0,21	0,98	0,22	0,98	0,22	1
2	1,96	0,42	1,95	0,42	1,95	0,43	1,95	0,44	2
3	2,93	0,62	2,93	0,64	2,93	0,65	2,93	0,66	3
4	3,91	0,83	3,91	0,85	3,91	0,87	3,90	0,88	4
5	4,89	1,04	4,89	1,06	4,88	1,08	4,88	1,10	5
6	5,87	1,25	5,86	1,27	5,86	1,30	5,85	1,32	6
7	6,85	1,46	6,84	1,49	6,83	1,52	6,83	1,54	7
8	7,83	1,66	7,82	1,70	7,81	1,73	7,80	1,77	8
9	8,80	1,87	8,80	1,91	8,79	1,95	8,78	1,99	9
10	9,78	2,08	9,77	2,12	9,76	2,16	9,75	2,21	10
11	10,76	2,29	10,75	2,33	10,74	2,38	10,73	2,43	11
12	11,74	2,49	11,73	2,55	11,72	2,60	11,70	2,65	12
13	12,72	2,70	12,70	2,76	12,69	2,81	12,68	2,87	13
14	13,69	2,91	13,68	2,97	13,67	3,03	13,65	3,09	14
15	14,67	3,12	14,66	3,18	14,64	3,25	14,63	3,31	15
16	15,65	3,33	15,64	3,39	15,62	3,46	15,61	3,53	16
17	16,63	3,53	16,61	3,61	16,60	3,68	16,58	3,75	17
18	17,61	3,74	17,59	3,82	17,57	3,90	17,56	3,97	18
19	18,58	3,95	18,57	4,03	18,55	4,11	18,53	4,19	19
20	19,56	4,16	19,54	4,24	19,53	4,33	19,51	4,41	20
21	20,54	4,37	20,52	4,46	20,50	4,55	20,48	4,63	21
22	21,52	4,57	21,50	4,67	21,48	4,76	21,46	4,86	22
23	22,50	4,78	22,48	4,88	22,45	4,98	22,43	5,08	23
24	23,48	4,99	23,45	5,09	23,43	5,19	23,41	5,30	24
25	24,45	5,20	24,43	5,30	24,41	5,41	24,38	5,52	25
26	25,43	5,41	25,41	5,52	25,38	5,63	25,36	5,74	26
27	26,41	5,61	26,39	5,73	26,36	5,84	26,33	5,96	27
28	27,39	5,82	27,36	5,94	27,34	6,06	27,31	6,18	28
29	28,37	6,03	28,34	6,15	28,31	6,28	28,28	6,40	29
30	29 34	6,24	29,32	6,37	29,29	6,49	29,26	6,62	30
31	30,32	6,45	30,29	6,58	30,27	6,71	30,24	6,84	31
32	31,30	6,65	31,27	6,79	31,24	6,93	31,21	7,06	32
33	32,28	6,86	32,25	7,00	32,22	7,14	32,19	7,28	33
34	33,26	7,07	33,23	7,21	33,19	7,36	33,16	7,50	34
35	34,24	7,28	34,20	7,43	34,17	7,58	34,14	7,72	35
36	35,21	7,48	35,18	7,64	35,15	7,79	35,11	7,95	36
37	36,19	7,69	36,16	7,85	36,12	8,01	36,09	8,17	37
38	37,17	7,90	37,13	8,06	37,10	8,22	37,06	8,39	38
39	38,15	8,11	38,11	8,27	38,08	8,44	38,04	8,61	39
40	39,13	8,32	39,09	8,49	39,05	8,66	39,01	8,83	40
41	40,10	8,52	40,07	8,70	40,03	8,87	39,99	9,05	41
42	41,08	8,73	41,04	8,91	41,00	9,09	40,96	9,27	42
43	42,06	8,94	42,02	9,12	41,98	9,31	41,94	9,49	43
44	43,04	9,15	43,00	9,34	42,96	9,52	42,92	9,71	44
45	44,02	9,36	43,98	9,55	43,93	9,74	43,89	9,93	45
46	44,99	9,56	44,95	9,76	44,91	9,96	44,87	10,15	46
47	45,97	9,77	45,93	9,97	45,89	10,17	45,84	10,37	47
48	46,95	9,98	46,91	10,18	46,86	10,39	46,82	10,59	48
49	47,93	10,19	47,88	10,40	47,84	10,61	47,79	10,81	49
50	48,91	10.40	48,86	10,61	48,81	10,82	48,77	11,03	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	78 Deg.		77¾ Deg.		77½ Deg.		77¼ Deg.		

Dist.	12 Deg. Lat.	12 Deg. Dep.	12¼ Deg. Lat.	12¼ Deg. Dep.	12½ Deg. Lat.	12½ Deg. Dep.	12¾ Deg. Lat.	12¾ Deg. Dep.	Dist.
51	49,89	10,60	49,84	10,82	49,79	11,04	49,74	11,26	51
52	50,86	10,81	50,82	11,03	50,77	11,25	50,72	11,48	52
53	51,84	11,02	51,79	11,25	51,74	11,47	51,69	11,70	53
54	52,82	11,23	52,77	11,46	52,72	11,69	52,67	11,92	54
55	53,80	11,44	53,75	11,67	53,70	11,90	53,64	12,14	55
56	54,78	11,64	54,72	11,88	54,67	12,12	54,62	12,36	56
57	55,75	11,85	55,70	12,09	55,65	12,34	55,59	12,58	57
58	56,73	12,06	56,68	12,31	56,63	12,55	56,57	12,80	58
59	57,71	12,27	57,66	12,52	57,60	12,77	57,55	13,02	59
60	58,69	12,47	58,63	12,73	58,58	12,99	58,52	13,24	60
61	59,67	12,68	59,61	12,94	59,55	13,20	59,50	13,46	61
62	60,65	12,89	60,59	13,16	60,53	13,42	60,47	13,68	62
63	61,62	13,10	61,57	13,37	61,51	13,64	61,45	13,90	63
64	62,60	13,31	62,54	13,58	62,48	13,85	62,42	14,12	64
65	63,58	13,51	63,52	13,79	63,46	14,07	63,40	14,35	65
66	64,56	13,72	64,50	14,00	64,44	14,29	64,37	14,57	66
67	65,54	13,93	65,47	14,22	65,41	14,50	65,35	14,79	67
68	66,51	14,14	66,45	14,43	66,39	14,72	66,32	15,01	68
69	67,49	14,35	67,43	14,64	67,36	14,93	67,30	15,23	69
70	68,47	14,55	68,41	14,85	68,34	15,15	68,27	15,45	70
71	69,45	14,76	69,38	15,06	69,32	15,37	69,25	15,67	71
72	70,43	14,97	70,36	15,28	70,29	15,58	70,22	15,89	72
73	71,40	15,18	71,34	15,49	71,27	15,80	71,20	16,11	73
74	72,38	15,39	72,32	15,70	72,25	16,02	72,18	16,33	74
75	73,36	15,59	73,29	15,91	73,22	16,23	73,15	16,55	75
76	74,34	15,80	74,27	16,13	74,20	16,45	74,13	16,77	76
77	75,32	16,01	75,25	16,34	75,17	16,67	75,10	16,99	77
78	76,30	16,22	76,22	16,55	76,15	16,88	76,08	17,21	78
79	77,27	16,43	77,20	16,76	77,13	17,10	77,05	17,44	79
80	78,25	16,63	78,18	16,97	78,10	17,32	78,03	17,66	80
81	79,23	16,84	79,16	17,19	79,08	17,53	79,00	17,88	81
82	80,21	17,05	80,13	17,40	80,06	17,75	79,98	18,10	82
83	81,19	17,26	81,11	17,61	81,03	17,96	80,95	18,32	83
84	82,16	17,46	82,09	17,82	82,01	18,18	81,93	18,54	84
85	83,14	17,67	83,06	18,04	82,99	18,40	82,90	18,76	85
86	84,12	17,88	84,04	18,25	83,96	18,61	83,88	18,98	86
87	85,10	18,09	85,02	18,46	84,94	18,83	84,85	19,20	87
88	86,08	18,30	86,00	18,67	85,91	19,05	85,83	19,42	88
89	87,06	18,50	86,97	18,88	86,89	19,26	86,81	19,64	89
90	88,03	18,71	87,95	19,10	87,87	19,48	87,78	19,86	90
91	89,01	18,92	88,93	19,31	88,84	19,70	88,76	20,08	91
92	89,99	19,13	89,91	19,52	89,82	19,91	89,73	20,30	92
93	90,97	19,34	90,88	19,73	90,80	20,13	90,71	20,52	93
94	91,95	19,54	91,86	19,94	91,77	20,35	91,68	20,75	94
95	92,92	19,75	92,84	20,16	92,75	20,56	92,66	20,97	95
96	93,90	19,96	93,81	20,37	93,72	20,78	93,63	21,19	96
97	94,88	20,17	94,79	20,58	94,70	20,99	94,61	21,41	97
98	95,86	20,38	95,77	20,79	95,68	21,21	95,58	21,63	98
99	96,84	20,58	96,75	21,01	96,65	21,43	96,56	21,85	99
100	97,81	20,79	97,72	21,22	97,63	21,64	97,53	22,07	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	78 Deg.		77¾ Deg.		77½ Deg.		77¼ Deg.		

Dist.	13 Deg.		13¼ Deg.		13½ Deg.		13¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,97	0,23	0,97	0,23	0,97	0,23	0,97	0,24	1
2	1,95	0,45	1,95	0,46	1,95	0,47	1,94	0,48	2
3	2,92	0,67	2,92	0,69	2,92	0,70	2,91	0,71	3
4	3,90	0,90	3,89	0,92	3,89	0,93	3,89	0,95	4
5	4,87	1,12	4,87	1,15	4,86	1,17	4,86	1,19	5
6	5,85	1,35	5,84	1,38	5,83	1,40	5,83	1,43	6
7	6,82	1,57	6,81	1,60	6,81	1,63	6,80	1,66	7
8	7,80	1,80	7,79	1,83	7,78	1,87	7,77	1,90	8
9	8,77	2,02	8,76	2,06	8,75	2,10	8,74	2,14	9
10	9,74	2,25	9,73	2,29	9,72	2,33	9,71	2,38	10
11	10,72	2,47	10,71	2,52	10,70	2,57	10,68	2,61	11
12	11,69	2,70	11,68	2,75	11,67	2,80	11,66	2,85	12
13	12,67	2,92	12,65	2,98	12,64	3,03	12,63	3,09	13
14	13,64	3,15	13,63	3,21	13,61	3,27	13,60	3,33	14
15	14,62	3,37	14,60	3,44	14,59	3,50	14,57	3,57	15
16	15,59	3,60	15,57	3,67	15,56	3,74	15,54	3,80	16
17	16,57	3,82	16,55	3,90	16,53	3,97	16,51	4,04	17
18	17,54	4,05	17,52	4,13	17,50	4,20	17,48	4,28	18
19	18,51	4,27	18,49	4,35	18,48	4,44	18,46	4,52	19
20	19,49	4,50	19,47	4,58	19,45	4,67	19,43	4,75	20
21	20,46	4,72	20,44	4,81	20,42	4,90	20,40	4,99	21
22	21,44	4,95	21,41	5,04	21,39	5,14	21,37	5,23	22
23	22,41	5,17	22,39	5,27	22,36	5,37	22,34	5,47	23
24	23,38	5,40	23,36	5,50	23,34	5,60	23,31	5,70	24
25	24,36	5,62	24,33	5,73	24,31	5,84	24,28	5,94	25
26	25,33	5,85	25,31	5,96	25,28	6,07	25,25	6,18	26
27	26,31	6,07	26,28	6,19	26,25	6,30	26,23	6,42	27
28	27,28	6,30	27,25	6,42	27,23	6,54	27,20	6,66	28
29	28,26	6,52	28,23	6,65	28,20	6,77	28,17	6,89	29
30	29,23	6,75	29,20	6,88	29,17	7,00	29,14	7,13	30
31	30,21	6,97	30,17	7,11	30,14	7,24	30,11	7,37	31
32	31,18	7,20	31,15	7,33	31,12	7,47	31,08	7,61	32
33	32,15	7,42	32,12	7,56	32,09	7,70	32,05	7,84	33
34	33,13	7,65	33,09	7,79	33,06	7,94	33,03	8,08	34
35	34,10	7,87	34,07	8,02	34,03	8,17	34,00	8,32	35
36	35,08	8,10	35,04	8,25	35,01	8,40	34,97	8,56	36
37	36,05	8,32	36,02	8,48	35,98	8,64	35,94	8,79	37
38	37,03	8,55	36,99	8,71	36,95	8,87	36,91	9,03	38
39	38,00	8,77	37,96	8,94	37,92	9,10	37,88	9,27	39
40	38,97	9,00	38,94	9,17	38,89	9,34	38,85	9,51	40
41	39,95	9,22	39,91	9,40	39,87	9,57	39,83	9,75	41
42	40,92	9,45	40,88	9,63	40,84	9,80	40,80	9,98	42
43	41,90	9,67	41,86	9,86	41,81	10,04	41,77	10,22	43
44	42,87	9,90	42,83	10,08	42,78	10,27	42,74	10,46	44
45	43,85	10,12	43,80	10,31	43,76	10,51	43,71	10,70	45
46	44,82	10,35	44,78	10,54	44,73	10,74	44,68	10,93	46
47	45,80	10,57	45,75	10,77	45,70	10,97	45,65	11,17	47
48	46,77	10,80	46,72	11,00	46,67	11,21	46,62	11,41	48
49	47,74	11,02	47,70	11,23	47,65	11,44	47,60	11,65	49
50	48,72	11,25	48,67	11,46	48,62	11,67	48,57	11,88	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	77 Deg.		76¾ Deg.		76½ Deg.		76¼ Deg.		

Dist.	13 Deg.		13¼ Deg.		13½ Deg.		13¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	49,69	11,47	49,64	11,69	49,59	11,91	49,54	12,12	51
52	50,67	11,70	50,62	11,92	50,56	12,14	50,51	12,36	52
53	51,64	11,92	51,59	12,15	51,54	12,37	51,48	12,60	53
54	52,62	12,15	52,56	12,38	52,51	12,61	52,45	12,84	54
55	53,59	12,37	53,54	12,61	53,48	12,84	53,42	13,07	55
56	54,56	12,60	54,51	12,84	54,45	13,07	54,40	13,31	56
57	55,54	12,82	55,48	13,06	55,43	13,31	55,37	13,55	57
58	56,51	13,05	56,46	13,29	56,40	13,54	56,34	13,79	58
59	57,49	13,27	57,43	13,52	57,37	13,77	57,31	14,02	59
60	58,46	13,50	58,40	13,75	58,34	14,01	58,28	14,26	60
61	59,44	13,72	59,38	13,98	59,31	14,24	59,25	14,50	61
62	60,41	13,95	60,35	14,21	60,29	14,47	60,22	14,74	62
63	61,39	14,17	61,32	14,44	61,26	14,71	61,19	14,97	63
64	62,36	14,40	62,30	14,67	62,23	14,94	62,17	15,21	64
65	63,33	14,62	63,27	14,90	63,20	15,17	63,14	15,45	65
66	64,31	14,85	64,24	15,13	64,18	15,41	64,11	15,69	66
67	65,28	15,07	65,22	15,36	65,15	15,64	65,08	15,93	67
68	66,26	15,30	66,19	15,59	66,12	15,87	66,05	16,16	68
69	67,23	15,52	67,16	15,81	67,09	16,11	67,02	16,40	69
70	68,21	15,75	68,14	16,04	68,07	16,34	67,99	16,64	70
71	69,18	15,97	69,11	16,27	69,04	16,57	68,97	16,88	71
72	70,15	16,20	70,08	16,50	70,01	16,81	69,94	17,11	72
73	71,13	16,42	71,06	16,73	70,98	17,04	70,91	17,35	73
74	72,10	16,65	72,03	16,96	71,96	17,28	71,88	17,59	74
75	73,08	16,87	73,00	17,19	72,93	17,50	72,85	17,83	75
76	74,05	17,10	73,98	17,42	73,90	17,74	73,82	18,06	76
77	75,03	17,32	74,95	17,65	74,87	17,98	74,79	18,30	77
78	76,00	17,55	75,92	17,88	75,84	18,21	75,76	18,54	78
79	76,98	17,77	76,90	18,11	76,82	18,44	76,74	18,78	79
80	77,95	18,00	77,87	18,34	77,79	18,68	77,71	19,01	80
81	78,92	18,22	78,84	18,57	78,76	18,91	78,68	19,25	81
82	79,90	18,45	79,82	18,79	79,73	19,14	79,65	19,49	82
83	80,87	18,67	80,79	19,02	80,71	19,38	80,62	19,73	83
84	81,85	18,90	81,76	19,25	81,68	19,61	81,59	19,97	84
85	82,82	19,12	82,74	19,48	82,65	19,84	82,56	20,20	85
86	83,80	19,35	83,71	19,71	83,62	20,08	83,54	20,44	86
87	84,77	19,57	84,68	19,94	84,60	20,31	84,51	20,68	87
88	85,74	19,80	85,66	20,17	85,57	20,54	85,48	20,92	88
89	86,72	20,02	86,63	20,40	86,54	20,78	86,45	21,15	89
90	87,69	20,25	87,60	20,63	87,51	21,01	87,42	21,39	90
91	88,67	20,47	88,58	20,86	88,49	21,24	88,39	21,63	91
92	89,64	20,70	89,55	21,09	89,46	21,48	89,36	21,87	92
93	90,62	20,92	90,52	21,32	90,43	21,71	90,33	22,10	93
94	91,59	21,15	91,50	21,54	91,40	21,94	91,31	22,34	94
95	92,57	21,37	92,47	21,77	92,38	22,18	92,28	22,58	95
96	93,54	21,60	93,44	22,00	93,35	22,41	93,25	22,82	96
97	94,51	21,82	94,42	22,23	94,32	22,64	94,22	23,06	97
98	95,49	22,05	95,39	22,46	95,29	22,88	95,19	23,29	98
99	96,46	22,27	96,36	22,69	96,26	23,11	96,16	23,53	99
100	97,44	22,50	97,34	22,92	97,24	23,34	97,13	23,77	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep	Lat.	Dist.
	77 Deg.		76¾ Deg.		76½ Deg.		76¼ Deg.		

Dist.	14 Deg.		14¼ Deg.		14½ Deg.		14¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,97	0,24	0,97	0,25	0,97	0,25	0,97	0,25	1
2	1,94	0,48	1,94	0,49	1,94	0,50	1,93	0,51	2
3	2,91	0,73	2,91	0,74	2,90	0,75	2,90	0,76	3
4	3,88	0,97	3,88	0,98	3,87	1,00	3,87	1,02	4
5	4,85	1,21	4,85	1,23	4,84	1,25	4,84	1,27	5
6	5,82	1,45	5,82	1,48	5,81	1,50	5,80	1,53	6
7	6,79	1,69	6,78	1,72	6,78	1,75	6,77	1,78	7
8	7,76	1,94	7,75	1,97	7,75	2,00	7,74	2,04	8
9	8,73	2,18	8,72	2,22	8,71	2,25	8,70	2,29	9
10	9,70	2,42	9,69	2,46	9,68	2,50	9,67	2,55	10
11	10,67	2,66	10,66	2,71	10,65	2,75	10,64	2,80	11
12	11,64	2,90	11,63	2,95	11,62	3,00	11,60	3,06	12
13	12,61	3,15	12,60	3,20	12,59	3,25	12,57	3,31	13
14	13,58	3,39	13,57	3,45	13,55	3,51	13,54	3,56	14
15	14,55	3,63	14,54	3,69	14,52	3,76	14,51	3,82	15
16	15,52	3,87	15,51	3,94	15,49	4,01	15,47	4,07	16
17	16,50	4,11	16,48	4,18	16,46	4,26	16,44	4,33	17
18	17,47	4,35	17,45	4,43	17,43	4,51	17,41	4,58	18
19	18,44	4,60	18,42	4,68	18,39	4,76	18,37	4,84	19
20	19,41	4,84	19,38	4,92	19,36	5,01	19,34	5,09	20
21	20,38	5,08	20,35	5,17	20,33	5,26	20,31	5,35	21
22	21,35	5,32	21,32	5,42	21,30	5,51	21,28	5,60	22
23	22,32	5,56	22,29	5,66	22,27	5,76	22,24	5,86	23
24	23,29	5,81	23,26	5,91	23,24	6,01	23,21	6,11	24
25	24,26	6,05	24,23	6,15	24,20	6,26	24,18	6,37	25
26	25,23	6,29	25,20	6,40	25,17	6,51	25,14	6,62	26
27	26,20	6,53	26,17	6,65	26,14	6,76	26,11	6,87	27
28	27,17	6,77	27,14	6,89	27,11	7,01	27,08	7,13	28
29	28,14	7,02	28,11	7,14	28,08	7,26	28,04	7,38	29
30	29 11	7,26	29,08	7,38	29,04	7,51	29,01	7,64	30
31	30,08	7,50	30,05	7,63	30,01	7,76	29,98	7,89	31
32	31,05	7,74	31,02	7,88	30,98	8,01	30,95	8,15	32
33	32,02	7,98	31,98	8,12	31,95	8,26	31,91	8,40	33
34	32,99	8,23	32,95	8,37	32,92	8,51	32,88	8,66	34
35	33,96	8,47	33,92	8,62	33,89	8,76	33,85	8,91	35
36	34,93	8,71	34,89	8,86	34,85	9,01	34,81	9,17	36
37	35,90	8,95	35,86	9,11	35,82	9,26	35,78	9,42	37
38	36,87	9,19	36,83	9,35	36,79	9,51	36,75	9,67	38
39	37,84	9,44	37,80	9,60	37,76	9,76	37,71	9,93	39
40	38,81	9,68	38,77	9,85	38,73	10,02	38,68	10,18	40
41	39,78	9,92	39,74	10,09	39,69	10,27	39,65	10,44	41
42	40,75	10,16	40,71	10,34	40,66	10,52	40,62	10,69	42
43	41,72	10,40	41,68	10,58	41,63	10,77	41,58	10,95	43
44	42,69	10,64	42,65	10,83	42,60	11,02	42,55	11,20	44
45	43,66	10,89	43,62	11,08	43,57	11,27	43,52	11,46	45
46	44,63	11,13	44,58	11,32	44,53	11,52	44,48	11,71	46
47	45,60	11,37	45,55	11,57	45,50	11,77	45,45	11,97	47
48	46,57	11,61	46,52	11,82	46,47	12,02	46,42	12,22	48
49	47,54	11,85	47,49	12,06	47,44	12,27	47,39	12,48	49
50	48,51	12,10	48,46	12,31	48,41	12,52	48,35	12,73	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	76 Deg.		75¾ Deg.		75½ Deg.		75¼ Deg.		

Dist.	14 Deg. Lat.	14 Deg. Dep.	14¼ Deg. Lat.	14¼ Deg. Dep.	14½ Deg. Lat.	14½ Deg. Dep.	14¾ Deg. Lat.	14¾ Deg. Dep.	Dist.
51	49,49	12,34	49,43	12,55	49,38	12,77	49,32	12,98	51
52	50,46	12,58	50,40	12,80	50,34	13,02	50,29	13,24	52
53	51,43	12,82	51,37	13,05	51,31	13,27	51,25	13,49	53
54	52,40	13,06	52,34	13,29	52,28	13,52	52,22	13,75	54
55	53,37	13,31	53,31	13,54	53,25	13,77	53,19	14,00	55
56	54,34	13,55	54,28	13,78	54,22	14,02	54,15	14,26	56
57	55,31	13,79	55,25	14,03	55,18	14,27	55,12	14,51	57
58	56,28	14,03	56,22	14,28	56,15	14,52	56,09	14,77	58
59	57,25	14,27	57,18	14,52	57,12	14,77	57,06	15,02	59
60	58,22	14,52	58,15	14,77	58,09	15,02	58,02	15,28	60
61	59,19	14,76	59,12	15,02	59,06	15,27	58,99	15,53	61
62	60,16	15,00	60,09	15,26	60,03	15,52	59,96	15,79	62
63	61,13	15,24	61,06	15,51	60,99	15,77	60,92	16,04	63
64	62,10	15,48	62,03	15,75	61,96	16,02	61,89	16,29	64
65	63,07	15,72	63,00	16,00	62,93	16,27	62,86	16,55	65
66	64,04	15,97	63,97	16,25	63,90	16,53	63,83	16,80	66
67	65,01	16,21	64,94	16,49	64,87	16,78	64,79	17,06	67
68	65,98	16,45	65,91	16,74	65,83	17,03	65,76	17,31	68
69	66,95	16,69	66,88	16,98	66,80	17,28	66,73	17,57	69
70	67,92	16,93	67,85	17,23	67,77	17,53	67,69	17,82	70
71	68,89	17,18	68,82	17,48	68,74	17,78	68,66	18,08	71
72	69,86	17,42	69,78	17,72	69,71	18,03	69,63	18,33	72
73	70,83	17,66	70,75	17,97	70,67	18,28	70,59	18,59	73
74	71,80	17,90	71,72	18,22	71,64	18,53	71,56	18,84	74
75	72,77	18,14	72,69	18,46	72,61	18,78	72,53	19,10	75
76	73,74	18,39	73,66	18,71	73,58	19,03	73,50	19,35	76
77	74,71	18,63	74,63	18,95	74,55	19,28	74,46	19,60	77
78	75,68	18,87	75,60	19,20	75,52	19,53	75,43	19,86	78
79	76,65	19,11	76,57	19,45	76,48	19,78	76,40	20,11	79
80	77,62	19,35	77,54	19,69	77,45	20,03	77,36	20,37	80
81	78,59	19,60	78,51	19,94	78,42	20,28	78,33	20,62	81
82	79,56	19,84	79,48	20,18	79,39	20,53	79,30	20,88	82
83	80,53	20,08	80,45	20,43	80,36	20,78	80,26	21,13	83
84	81,50	20,32	81,42	20,68	81,32	21,03	81,23	21,39	84
85	82,48	20,56	82,38	20,92	82,29	21,28	82,20	21,64	85
86	83,45	20,81	83,35	21,17	83,26	21,53	83,17	21,90	86
87	84,42	21,05	84,32	21,42	84,23	21,78	84,13	22,15	87
88	85,39	21,29	85,29	21,66	85,20	22,03	85,10	22,41	88
89	86,36	21,53	86,26	21,91	86,17	22,28	86,07	22,66	89
90	87,33	21,77	87,23	22,15	87,13	22,53	87,03	22,91	90
91	88,30	22,01	88,20	22,40	88,10	22,78	88,00	23,17	91
92	89,27	22,26	89,17	22,65	89,07	23,04	88,97	23,42	92
93	90,24	22,50	90,14	22,89	90,04	23,29	89,94	23,68	93
94	91,21	22,74	91,11	23,14	91,01	23,54	90,90	23,93	94
95	92,18	22,98	92,08	23,38	91,97	23,79	91,87	24,19	95
96	93,15	23,22	93,05	23,63	92,94	24,04	92,84	24,44	96
97	94,12	23,47	94,02	23,88	93,91	24,29	93,80	24,70	97
98	95,09	23,71	94,98	24,12	94,88	24,54	94,77	24,95	98
99	96,06	23,95	95,95	24,37	95,85	24,79	95,74	25,21	99
100	97,03	24,19	96,92	24,62	96,81	25,04	96,70	25,46	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	76 Deg.		75¾ Deg.		75½ Deg.		75¼ Deg.		

Dist.	15 Deg.		15¼ Deg.		15½ Deg.		15¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,97	0,26	0,96	0,26	0,96	0,27	0,96	0,27	1
2	1,93	0,52	1,93	0,53	1,93	0,53	1,92	0,54	2
3	2,90	0,78	2,89	0,79	2,89	0,80	2,89	0,81	3
4	3,86	1,04	3,86	1,05	3,85	1,07	3,85	1,09	4
5	4,83	1,29	4,82	1,32	4,82	1,34	4,81	1,36	5
6	5,80	1,55	5,79	1,58	5,78	1,60	5,77	1,63	6
7	6,76	1,81	6,75	1,84	6,75	1,87	6,74	1,90	7
8	7,73	2,07	7,72	2,10	7,71	2,14	7,70	2,17	8
9	8,69	2,33	8,68	2,37	8,67	2,41	8,66	2,44	9
10	9,66	2,59	9,65	2,63	9,64	2,67	9,62	2,71	10
11	10,63	2,85	10,61	2,89	10,60	2,94	10,59	2,99	11
12	11,59	3,11	11,58	3,16	11,56	3,21	11,55	3,26	12
13	12,56	3,36	12,54	3,42	12,53	3,47	12,51	3,53	13
14	13,52	3,62	13,51	3,68	13,49	3,74	13,47	3,80	14
15	14,49	3,88	14,47	3,95	14,45	4,01	14,44	4,07	15
16	15,45	4,14	15,44	4,21	15,42	4,28	15,40	4,34	16
17	16,42	4,40	16,40	4,47	16,38	4,54	16,36	4,61	17
18	17,39	4,66	17,37	4,73	17,35	4,81	17,32	4,89	18
19	18,35	4,92	18,33	5,00	18,31	5,08	18,29	5,16	19
20	19,32	5,18	19,30	5,26	19,27	5,34	19,25	5,43	20
21	20,28	5,44	20,26	5,52	20,24	5,61	20,21	5,70	21
22	21,25	5,69	21,23	5,79	21,20	5,88	21,17	5,97	22
23	22,22	5,95	22,19	6,05	22,16	6,15	22,14	6,24	23
24	23,18	6,21	23,15	6,31	23,13	6,41	23,10	6,51	24
25	24,15	6,47	24,12	6,58	24,09	6,68	24,06	6,79	25
26	25,11	6,73	25,08	6,84	25,05	6,95	25,02	7,06	26
27	26,08	6,99	26,05	7,10	26,02	7,22	25,99	7,33	27
28	27,05	7,25	27,01	7,36	26,98	7,48	26,95	7,60	28
29	28,01	7,51	27,98	7,63	27,95	7,75	27,91	7,87	29
30	28,98	7,76	28,94	7,89	28,91	8,02	28,87	8,14	30
31	29,94	8,02	29,91	8,15	29,87	8,28	29,84	8,41	31
32	30,91	8,28	30,87	8,42	30,84	8,55	30,80	8,69	32
33	31,88	8,54	31,84	8,68	31,80	8,82	31,76	8,96	33
34	32,84	8,80	32,80	8,94	32,76	9,09	32,72	9,23	34
35	33,81	9,06	33,77	9,21	33,73	9,35	33,69	9,50	35
36	34,77	9,32	34,73	9,47	34,69	9,62	34,65	9,77	36
37	35,74	9,58	35,70	9,73	35,65	9,89	35,61	10,04	37
38	36,71	9,84	36,66	10,00	36,62	10,16	36,57	10,31	38
39	37,67	10,09	37,63	10,26	37,58	10,42	37,54	10,59	39
40	38,64	10,35	38,59	10,52	38,55	10,69	38,50	10,86	40
41	39,60	10,61	39,56	10,78	39,51	10,96	39,46	11,13	41
42	40,57	10,87	40,52	11,05	40,47	11,22	40,42	11,40	42
43	41,53	11,13	41,49	11,31	41,44	11,49	41,39	11,67	43
44	42,50	11,39	42,45	11,57	42,40	11,76	42,35	11,94	44
45	43,47	11,65	43,42	11,84	43,36	12,03	43,31	12,21	45
46	44,43	11,91	44,38	12,10	44,33	12,29	44,27	12,49	46
47	45,40	12,16	45,35	12,36	45,29	12,56	45,24	12,76	47
48	46,36	12,42	46,31	12,63	46,25	12,83	46,20	13,03	48
49	47,33	12,68	47,27	12,89	47,22	13,09	47,16	13,30	49
50	48,30	12,94	48,24	13,15	48,18	13,36	48,12	13,57	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	75 Deg.		74¾ Deg.		74½ Deg.		74¼ Deg.		

Dist.	15 Deg. Lat.	15 Deg. Dep.	15¼ Deg. Lat.	15¼ Deg. Dep.	15½ Deg. Lat.	15½ Deg. Dep.	15¾ Deg. Lat.	15¾ Deg. Dep.	Dist.
51	49,26	13,20	49,20	13,41	49,15	13,63	49,09	13,84	51
52	50,23	13,46	50,17	13,68	50,11	13,90	50,05	14,11	52
53	51,19	13,72	51,13	13,94	51,07	14,16	51,01	14,39	53
54	52,16	13,98	52,10	14,20	52,04	14,43	51,97	14,66	54
55	53,13	14,24	53,06	14,47	53,00	14,70	52,94	14,93	55
56	54,09	14,49	54,03	14,73	53,96	14,97	53,90	15,20	56
57	55,06	14,75	54,99	14,99	54,93	15,23	54,86	15,47	57
58	56,02	15,01	55,96	15,26	55,89	15,50	55,82	15,74	58
59	56,99	15,27	56,92	15,52	56,85	15,77	56,78	16,01	59
60	57,96	15,53	57,89	15,78	57,82	16,03	57,75	16,29	60
61	58,92	15,79	58,85	16,04	58,78	16,30	58,71	16,56	61
62	59,89	16,05	59,82	16,31	59,75	16,57	59,67	16,83	62
63	60,85	16,31	60,78	16,57	60,71	16,84	60,63	17,10	63
64	61,82	16,56	61,75	16,83	61,67	17,10	61,60	17,37	64
65	62,79	16,82	62,71	17,10	62,64	17,37	62,56	17,64	65
66	63,75	17,08	63,68	17,36	63,60	17,64	63,52	17,92	66
67	64,72	17,34	64,64	17,62	64,56	17,90	64,48	18,19	67
68	65,68	17,60	65,61	17,89	65,53	18,17	65,45	18,46	68
69	66,65	17,86	66,57	18,15	66,49	18,44	66,41	18,73	69
70	67,61	18,12	67,54	18,41	67,45	18,71	67,37	19,00	70
71	68,58	18,38	68,50	18,68	68,42	18,97	68,33	19,27	71
72	69,55	18,63	69,46	18,94	69,38	19,24	69,30	19,54	72
73	70,51	18,89	70,43	19,20	70,35	19,51	70,26	19,82	73
74	71,48	19,15	71,39	19,46	71,31	19,78	71,22	20,09	74
75	72,44	19,41	72,36	19,73	72,27	20,04	72,18	20,36	75
76	73,41	19,67	73,32	19,99	73,24	20,31	73,15	20,63	76
77	74,38	19,93	74,29	20,25	74,20	20,58	74,11	20,90	77
78	75,34	20,19	75,25	20,52	75,16	20,84	75,07	21,17	78
79	76,31	20,45	76,22	20,78	76,13	21,11	76,03	21,44	79
80	77,27	20,71	77,18	21,04	77,09	21,38	77,00	21,72	80
81	78,24	20,96	78,15	21,31	78,05	21,65	77,96	21,99	81
82	79,21	21,22	79,11	21,57	79,02	21,91	78,92	22,26	82
83	80,17	21,48	80,08	21,83	79,98	22,18	79,88	22,53	83
84	81,14	21,74	81,04	22,09	80,94	22,45	80,85	22,80	84
85	82,10	22,00	82,01	22,36	81,91	22,72	81,81	23,07	85
86	83,07	22,26	82,97	22,62	82,87	22,98	82,77	23,34	86
87	84,04	22,52	83,94	22,88	83,84	23,25	83,73	23,62	87
88	85,00	22,78	84,90	23,15	84,80	23,52	84,70	23,89	88
89	85,97	23,03	85,87	23,41	85,76	23,78	85,66	24,16	89
90	86,93	23,29	86,83	23,67	86,73	24,05	86,62	24,43	90
91	87,90	23,55	87,80	23,94	87,69	24,32	87,58	24,70	91
92	88,87	23,81	88,76	24,20	88,65	24,59	88,55	24,97	92
93	89,83	24,07	89,73	24,46	89,62	24,85	89,51	25,24	93
94	90,80	24,33	90,69	24,72	90,58	25,12	90,47	25,52	94
95	91,76	24,59	91,65	24,99	91,54	25,39	91,43	25,79	95
96	92,73	24,85	92,62	25,25	92,51	25,65	92,40	26,06	96
97	93,69	25,11	93,58	25,51	93,47	25,92	93,36	26,33	97
98	94,66	25,36	94,55	25,78	94,44	26,19	94,32	26,60	98
99	95,63	25,62	95,51	26,04	95,40	26,46	95,28	26,87	99
100	96,59	25,88	96,48	26,30	96,36	26,72	96,25	27,14	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep	Lat.	Dist.
	75 Deg.		74¾ Deg.		74½ Deg.		74¼ Deg.		

Dist.	16 Deg. Lat.	16 Deg. Dep.	16¼ Deg. Lat.	16¼ Deg. Dep.	16½ Deg. Lat.	16½ Deg. Dep.	16¾ Deg. Lat.	16¾ Deg. Dep.	Dist.
1	0,96	0,28	0,96	0,28	0,96	0,28	0,96	0,29	1
2	1,92	0,55	1,92	0,56	1,92	0,57	1,92	0,58	2
3	2,88	0,83	2,88	0,84	2,88	0,85	2,87	0,86	3
4	3,85	1,10	3,84	1,12	3,84	1,14	3,83	1,15	4
5	4,81	1,38	4,80	1,40	4,79	1,42	4,79	1,44	5
6	5,77	1,65	5,76	1,68	5,75	1,70	5,75	1,73	6
7	6,73	1,93	6,72	1,96	6,71	1,99	6,70	2,02	7
8	7,69	2,21	7,68	2,24	7,67	2,27	7,66	2,31	8
9	8,65	2,48	8,64	2,52	8,63	2,56	8,62	2,59	9
10	9,61	2,76	9,60	2,80	9,59	2,84	9,58	2,88	10
11	10,57	3,03	10,56	3,08	10,55	3,12	10,53	3,17	11
12	11,54	3,31	11,52	3,36	11,51	3,41	11,49	3,46	12
13	12,50	3,58	12,48	3,64	12,46	3,69	12,45	3,75	13
14	13,46	3,86	13,44	3,92	13,42	3,98	13,41	4,03	14
15	14,42	4,13	14,40	4,20	14,38	4,26	14,36	4,32	15
16	15,38	4,41	15,36	4,48	15,34	4,54	15,32	4,61	16
17	16,34	4,69	16,32	4,76	16,30	4,83	16,28	4,90	17
18	17,30	4,96	17,28	5,04	17,26	5,11	17,24	5,19	18
19	18,26	5,24	18,24	5,32	18,22	5,40	18,19	5,48	19
20	19,23	5,51	19,20	5,60	19,18	5,68	19,15	5,76	20
21	20,19	5,79	20,16	5,88	20,14	5,96	20,11	6,05	21
22	21,15	6,06	21,12	6,16	21,09	6,25	21,07	6,34	22
23	22,11	6,34	22,08	6,44	22,05	6,53	22,02	6,63	23
24	23,07	6,62	23,04	6,72	23,01	6,82	22,98	6,92	24
25	24,03	6,89	24,00	7,00	23,97	7,10	23,94	7,20	25
26	24,99	7,17	24,96	7,28	24,93	7,38	24,90	7,49	26
27	25,95	7,44	25,92	7,56	25,89	7,67	25,85	7,78	27
28	26,92	7,72	26,88	7,84	26,85	7,95	26,81	8,07	28
29	27,88	7,99	27,84	8,11	27,81	8,24	27,77	8,36	29
30	28,84	8,27	28,80	8,39	28,76	8,52	28,73	8,65	30
31	29,80	8,54	29,76	8,67	29,72	8,80	29,68	8,93	31
32	30,76	8,82	30,72	8,95	30,68	9,09	30,64	9,22	32
33	31,72	9,10	31,68	9,23	31,64	9,37	31,60	9,51	33
34	32,68	9,37	32,64	9,51	32,60	9,66	32,56	9,80	34
35	33,64	9,65	33,60	9,79	33,56	9,94	33,51	10,09	35
36	34,61	9,92	34,56	10,07	34,52	10,22	34,47	10,38	36
37	35,57	10,20	35,52	10,35	35,48	10,51	35,43	10,66	37
38	36,53	10,47	36,48	10,63	36,44	10,79	36,39	10,95	38
39	37,49	10,75	37,44	10,91	37,39	11,08	37,35	11,24	39
40	38,45	11,03	38,40	11,19	38,35	11,36	38,30	11,53	40
41	39,41	11,30	39,36	11,47	39,31	11,64	39,26	11,82	41
42	40,37	11,58	40,32	11,75	40,27	11,93	40,22	12,10	42
43	41,33	11,85	41,28	12,03	41,23	12,21	41,18	12,39	43
44	42,30	12,13	42,24	12,31	42,19	12,50	42,13	12,68	44
45	43,26	12,40	43,20	12,59	43,15	12,78	43,09	12,97	45
46	44,22	12,68	44,16	12,87	44,11	13,06	44,05	13,26	46
47	45,18	12,95	45,12	13,15	45,06	13,35	45,01	13,55	47
48	46,14	13,23	46,08	13,43	46,02	13,63	45,96	13,83	48
49	47,10	13,51	47,04	13,71	46,98	13,92	46,92	14,12	49
50	48,06	13,78	48,00	13,99	47,94	14,20	47,88	14,41	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	74 Deg.		73¾ Deg.		73½ Deg.		73¼ Deg.		

Dist.	16 Deg.		16¼ Deg.		16½ Deg.		16¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	49,02	14,06	48,96	14,27	48,90	14,48	48,84	14,70	51
52	49,99	14,33	49,92	14,55	49,86	14,77	49,79	14,99	52
53	50,95	14,61	50,88	14,83	50,82	15,05	50,75	15,27	53
54	51,91	14,88	51,84	15,11	51,78	15,34	51,71	15,56	54
55	52,87	15,16	52,80	15,39	52,74	15,62	52,67	15,85	55
56	53,83	15,44	53,76	15,67	53,69	15,90	53,62	16,14	56
57	54,79	15,71	54,72	15,95	54,65	16,19	54,58	16,43	57
58	55,75	15,99	55,68	16,23	55,61	16,47	55,54	16,72	58
59	56,71	16,26	56,64	16,51	56,57	16,76	56,50	17,00	59
60	57,68	16,54	57,60	16,79	57,53	17,04	57,45	17,29	60
61	58,64	16,81	58,56	17,07	58,49	17,32	58,41	17,58	61
62	59,60	17,09	59,52	17,35	59,45	17,61	59,37	17,87	62
63	60,56	17,37	60,48	17,63	60,41	17,89	60,33	18,16	63
64	61,52	17,64	61,44	17,91	61,36	18,18	61,28	18,44	64
65	62,48	17,92	62,40	18,19	62,32	18,46	62,24	18,73	65
66	63,44	18,19	63,36	18,47	63,28	18,74	63,20	19,02	66
67	64,40	18,47	64,32	18,75	64,24	19,03	64,16	19,31	67
68	65,37	18,74	65,28	19,03	65,20	19,31	65,11	19,60	68
69	66,33	19,02	66,24	19,31	66,16	19,60	66,07	19,89	69
70	67,29	19,29	67,20	19,59	67,12	19,88	67,03	20,17	70
71	68,25	19,57	68,16	19,87	68,08	20,17	67,99	20,46	71
72	69,21	19,85	69,12	20,15	69,03	20,45	68,95	20,75	72
73	70,17	20,12	70,08	20,43	69,99	20,73	69,90	21,04	73
74	71,13	20,40	71,04	20,71	70,95	21,02	70,86	21,33	74
75	72,09	20,67	72,00	20,99	71,91	21,30	71,82	21,61	75
76	73,06	20,95	72,96	21,27	72,87	21,59	72,78	21,90	76
77	74,02	21,22	73,92	21,55	73,83	21,87	73,73	22,19	77
78	74,98	21,50	74,88	21,83	74,79	22,15	74,69	22,48	78
79	75,94	21,78	75,84	22,11	75,75	22,44	75,65	22,77	79
80	76,90	22,05	76,80	22,39	76,71	22,72	76,61	23,06	80
81	77,86	22,33	77,76	22,67	77,66	23,01	77,56	23,34	81
82	78,82	22,60	78,72	22,95	78,62	23,29	78,52	23,63	82
83	79,78	22,88	79,68	23,23	79,58	23,57	79,48	23,92	83
84	80,75	23,15	80,64	23,51	80,54	23,86	80,44	24,21	84
85	81,71	23,43	81,60	23,79	81,50	24,14	81,39	24,50	85
86	82,67	23,70	82,56	24,07	82,46	24,43	82,35	24,78	86
87	83,63	23,98	83,52	24,35	83,42	24,71	83,31	25,07	87
88	84,59	24,26	84,48	24,62	84,38	24,99	84,27	25,36	88
89	85,55	24,53	85,44	24,90	85,33	25,28	85,22	25,65	89
90	86,51	24,81	86,40	25,18	86,29	25,56	86,18	25,94	90
91	87,47	25,08	87,36	25,46	87,25	25,85	87,14	26,23	91
92	88,44	25,36	88,32	25,74	88,21	26,13	88,10	26,51	92
93	89,40	25,63	89,28	26,02	89,17	26,41	89,05	26,80	93
94	90,36	25,91	90,24	26,30	90,13	26,70	90,01	27,09	94
95	91,32	26,19	91,20	26,58	91,09	26,98	90,97	27,38	95
96	92,28	26,46	92,16	26,86	92,05	27,27	91,93	27,67	96
97	93,24	26,74	93,12	27,14	93,01	27,55	92,88	27,95	97
98	94,20	27,01	94,08	27,42	93,96	27,83	93,84	28,24	98
99	95,16	27,29	95,04	27,70	94,92	28,12	94,80	28,53	99
100	96,13	27,56	96,00	27,98	95,88	28,40	95,76	28,82	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	74 Deg.		73¾ Deg.		73½ Deg.		73¼ Deg.		

Dist.	17 Deg.		17¼ Deg.		17½ Deg.		17¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,96	0,29	0,95	0,30	0,95	0,30	0,95	0,30	1
2	1,91	0,58	1,91	0,59	1,91	0,60	1,90	0,61	2
3	2,87	0,88	2,87	0,89	2,86	0,90	2,86	0,91	3
4	3,83	1,17	3,82	1,19	3,81	1,20	3,81	1,22	4
5	4,78	1,46	4,78	1,48	4,77	1,50	4,76	1,52	5
6	5,74	1,75	5,73	1,78	5,72	1,80	5,71	1,83	6
7	6,69	2,05	6,69	2,08	6,68	2,10	6,67	2,13	7
8	7,65	2,34	7,64	2,37	7,63	2,41	7,62	2,44	8
9	8,61	2,63	8,60	2,67	8,58	2,71	8,57	2,74	9
10	9,56	2,92	9,55	2,97	9,54	3,01	9,52	3,05	10
11	10,52	3,22	10,51	3,26	10,49	3,31	10,48	3,35	11
12	11,48	3,51	11,46	3,56	11,44	3,61	11,43	3,66	12
13	12,43	3,80	12,42	3,85	12,40	3,91	12,38	3,96	13
14	13,39	4,09	13,37	4,15	13,35	4,21	13,33	4,27	14
15	14,34	4,39	14,33	4,45	14,31	4,51	14,29	4,57	15
16	15,30	4,68	15,28	4,74	15,26	4,81	15,24	4,88	16
17	16,26	4,97	16,24	5,04	16,21	5,11	16,19	5,18	17
18	17,21	5,26	17,19	5,34	17,17	5,41	17,14	5,49	18
19	18,17	5,56	18,15	5,63	18,12	5,71	18,10	5,79	19
20	19,13	5,85	19,10	5,93	19,07	6,01	19,05	6,10	20
21	20,08	6,14	20,06	6,23	20,03	6,31	20,00	6,40	21
22	21,04	6,43	21,01	6,52	20,98	6,62	20,95	6,71	22
23	21,99	6,72	21,97	6,82	21,94	6,92	21,91	7,01	23
24	22,95	7,02	22,92	7,12	22,89	7,22	22,86	7,32	24
25	23,91	7,31	23,88	7,41	23,84	7,52	23,81	7,62	25
26	24,86	7,60	24,83	7,71	24,80	7,82	24,76	7,93	26
27	25,82	7,89	25,79	8,01	25,75	8,12	25,71	8,23	27
28	26,78	8,19	26,74	8,30	26,70	8,42	26,67	8,54	28
29	27,73	8,48	27,70	8,60	27,66	8,72	27,62	8,84	29
30	28,69	8,77	28,65	8,90	28,61	9,02	28,57	9,15	30
31	29,65	9,06	29,61	9,19	29,57	9,32	29,52	9,45	31
32	30,60	9,36	30,56	9,49	30,52	9,62	30,48	9,76	32
33	31,56	9,65	31,52	9,79	31,47	9,92	31,43	10,06	33
34	32,51	9,94	32,47	10,08	32,42	10,22	32,38	10,37	34
35	33,47	10,23	33,43	10,38	33,38	10,52	33,33	10,67	35
36	34,43	10,53	34,38	10,68	34,33	10,83	34,29	10,98	36
37	35,38	10,82	35,34	10,97	35,29	11,13	35,24	11,28	37
38	36,34	11,11	36,29	11,27	36,24	11,43	36,19	11,58	38
39	37,30	11,40	37,25	11,57	37,19	11,73	37,14	11,89	39
40	38,25	11,69	38,20	11,86	38,15	12,03	38,10	12,19	40
41	39,21	11,99	39,16	12,16	39,10	12,33	39,05	12,50	41
42	40,16	12,28	40,11	12,45	40,06	12,63	40,00	12,80	42
43	41,12	12,57	41,07	12,75	41,01	12,93	40,95	13,11	43
44	42,08	12,86	42,02	13,05	41,96	13,23	41,91	13,41	44
45	43,03	13,16	42,98	13,34	42,92	13,53	42,86	13,72	45
46	43,99	13,45	43,93	13,64	43,87	13,83	43,81	14,02	46
47	44,95	13,74	44,89	13,94	44,82	14,13	44,76	14,33	47
48	45,90	14,03	45,84	14,23	45,78	14,43	45,71	14,63	48
49	46,86	14,33	46,80	14,53	46,73	14,73	46,67	14,94	49
50	47,82	14,62	47,75	14,83	47,69	15,04	47,62	15,24	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	73 Deg.		72¾ Deg.		72½ Deg.		72¼ Deg.		

Dist.	17 Deg.		17¼ Deg.		17½ Deg.		17¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	48,77	14,91	48,71	15,12	48,64	15,34	48,57	15,55	51
52	49,73	15,20	49,66	15,42	49,59	15,64	49,52	15,85	52
53	50,68	15,50	50,62	15,72	50,55	15,94	50,48	16,16	53
54	51,64	15,79	51,57	16,01	51,50	16,24	51,43	16,46	54
55	52,60	16,08	52,53	16,31	52,45	16,54	52,38	16,77	55
56	53,55	16,37	53,48	16,61	53,41	16,84	53,33	17,07	56
57	54,51	16,67	54,44	16,90	54,36	17,14	54,29	17,38	57
58	55,47	16,96	55,39	17,20	55,32	17,44	55,24	17,68	58
59	56,42	17,25	56,35	17,50	56,27	17,74	56,19	17,99	59
60	57,38	17,54	57,30	17,79	57,22	18,04	57,14	18,29	60
61	58,33	17,83	58,26	18,09	58,18	18,34	58,10	18,60	61
62	59,29	18,13	59,21	18,39	59,13	18,64	59,05	18,90	62
63	60,25	18,42	60,17	18,68	60,08	18,94	60,00	19,21	63
64	61,20	18,71	61,12	18,98	61,04	19,25	60,95	19,51	64
65	62,16	19,00	62,08	19,28	61,99	19,55	61,91	19,82	65
66	63,12	19,30	63,03	19,57	62,95	19,85	62,86	20,12	66
67	64,07	19,59	63,99	19,87	63,90	20,15	63,81	20,43	67
68	65,03	19,88	64,94	20,16	64,85	20,45	64,76	20,73	68
69	65,99	20,17	65,90	20,46	65,81	20,75	65,72	21,04	69
70	66,94	20,47	66,85	20,76	66,76	21,05	66,67	21,34	70
71	67,90	20,76	67,81	21,05	67,71	21,35	67,62	21,65	71
72	68,85	21,05	68,76	21,35	68,67	21,65	68,57	21,95	72
73	69,81	21,34	69,72	21,65	69,62	21,95	69,52	22,26	73
74	70,77	21,64	70,67	21,94	70,58	22,25	70,48	22,56	74
75	71,72	21,93	71,63	22,24	71,53	22,55	71,43	22,86	75
76	72,68	22,22	72,58	22,54	72,48	22,85	72,38	23,17	76
77	73,64	22,51	73,54	22,83	73,44	23,15	73,33	23,47	77
78	74,59	22,80	74,49	23,13	74,39	23,46	74,29	23,78	78
79	75,55	23,10	75,45	23,43	75,34	23,76	75,24	24,08	79
80	76,50	23,39	76,40	23,72	76,30	24,06	76,19	24,39	80
81	77,46	23,68	77,36	24,02	77,25	24,36	77,14	24,69	81
82	78,42	23,97	78,31	24,32	78,20	24,66	78,10	25,00	82
83	79,37	24,27	79,27	24,61	79,16	24,96	79,05	25,30	83
84	80,33	24,56	80,22	24,91	80,11	25,26	80,00	25,61	84
85	81,29	24,85	81,18	25,21	81,07	25,56	80,95	25,91	85
86	82,24	25,14	82,13	25,50	82,02	25,86	81,91	26,22	86
87	83,20	25,44	83,09	25,80	82,97	26,16	82,86	26,52	87
88	84,15	25,73	84,04	26,10	83,93	26,46	83,81	26,83	88
89	85,11	26,02	85,00	26,39	84,88	26,76	84,76	27,13	89
90	86,07	26,31	85,95	26,69	85,83	27,06	85,72	27,44	90
91	87,02	26,61	86,91	26,99	86,79	27,36	86,67	27,74	91
92	87,98	26,90	87,86	27,28	87,74	27,66	87,62	28,05	92
93	88,94	27,19	88,82	27,58	88,70	27,97	88,57	28,35	93
94	89,89	27,48	89,77	27,87	89,65	28,27	89,53	28,66	94
95	90,85	27,78	90,73	28,17	90,60	28,57	90,48	28,96	95
96	91,81	28,07	91,68	28,47	91,56	28,87	91,43	29,27	96
97	92,76	28,36	92,64	28,76	92,51	29,17	92,38	29,57	97
98	93,72	28,65	93,59	29,06	93,46	29,47	93,33	29,88	98
99	94,67	28,94	94,55	29,36	94,42	29,77	94,29	30,18	99
100	95,63	29,24	95,50	29,65	95,37	30,07	95,24	30,49	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	73 Deg.		72¾ Deg.		72½ Deg.		72¼ Deg.		

Dist.	18 Deg.		18¼ Deg.		18½ Deg.		18¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,95	0,31	0,95	0,31	0,95	0,32	0,95	0,32	1
2	1,90	0,62	1,90	0,63	1,90	0,63	1,89	0,64	2
3	2,85	0,93	2,85	0,94	2,84	0,95	2,84	0,96	3
4	3,80	1,24	3,80	1,25	3,79	1,27	3,79	1,29	4
5	4,76	1,55	4,75	1,57	4,74	1,59	4,73	1,61	5
6	5,71	1,85	5,70	1,88	5,69	1,90	5,68	1,93	6
7	6,66	2,16	6,65	2,19	6,64	2,22	6,63	2,25	7
8	7,61	2,47	7,60	2,51	7,59	2,54	7,58	2,57	8
9	8,56	2,78	8,55	2,82	8,53	2,86	8,52	2,89	9
10	9,51	3,09	9,50	3,13	9,48	3,17	9,47	3,21	10
11	10,46	3,40	10,45	3,44	10,43	3,49	10,42	3,54	11
12	11,41	3,71	11,40	3,76	11,38	3,81	11,36	3,86	12
13	12,36	4,02	12,35	4,07	12,33	4,12	12,31	4,18	13
14	13,31	4,33	13,30	4,38	13,28	4,44	13,26	4,50	14
15	14,27	4,64	14,25	4,70	14,22	4,76	14,20	4,82	15
16	15,22	4,94	15,20	5,01	15,17	5,08	15,15	5,14	16
17	16,17	5,25	16,14	5,32	16,12	5,39	16,10	5,46	17
18	17,12	5,56	17,09	5,64	17,07	5,71	17,04	5,79	18
19	18,07	5,87	18,04	5,95	18,02	6,03	17,99	6,11	19
20	19,02	6,18	18,99	6,26	18,97	6,35	18,94	6,43	20
21	19,97	6,49	19,94	6,58	19,91	6,66	19,89	6,75	21
22	20,92	6,80	20,89	6,89	20,86	6,98	20,83	7,07	22
23	21,87	7,11	21,84	7,20	21,81	7,30	21,78	7,39	23
24	22,83	7,42	22,79	7,52	22,76	7,62	22,73	7,71	24
25	23,78	7,73	23,74	7,83	23,71	7,93	23,67	8,04	25
26	24,73	8,03	24,69	8,14	24,66	8,25	24,62	8,36	26
27	25,68	8,34	25,64	8,46	25,60	8,57	25,57	8,68	27
28	26,63	8,65	26,59	8,77	26,55	8,88	26,51	9,00	28
29	27,58	8,96	27,54	9,08	27,50	9,20	27,46	9,32	29
30	28,53	9,27	28,49	9,39	28,45	9,52	28,41	9,64	30
31	29,48	9,58	29,44	9,71	29,40	9,84	29,35	9,96	31
32	30,43	9,89	30,39	10,02	30,35	10,15	30,30	10,29	32
33	31,38	10,20	31,34	10,33	31,29	10,47	31,25	10,61	33
34	32,34	10,51	32,29	10,65	32,24	10,79	32,20	10,93	34
35	33,29	10,82	33,24	10,96	33,19	11,11	33,14	11,25	35
36	34,24	11,12	34,19	11,27	34,14	11,42	34,09	11,57	36
37	35,19	11,43	35,14	11,59	35,09	11,74	35,04	11,89	37
38	36,14	11,74	36,09	11,90	36,04	12,06	35,98	12,21	38
39	37,09	12,05	37,04	12,21	36,98	12,37	36,93	12,54	39
40	38,04	12,36	37,99	12,53	37,93	12,69	37,88	12,86	40
41	38,99	12,67	38,94	12,84	38,88	13,01	38,82	13,18	41
42	39,94	12,98	39,89	13,15	39,83	13,33	39,77	13,50	42
43	40,90	13,29	40,84	13,47	40,78	13,64	40,72	13,82	43
44	41,85	13,60	41,79	13,78	41,73	13,96	41,66	14,14	44
45	42,80	13,91	42,74	14,09	42,67	14,28	42,61	14,46	45
46	43,75	14,21	43,69	14,41	43,62	14,60	43,56	14,79	46
47	44,70	14,52	44,64	14,72	44,57	14,91	44,51	15,11	47
48	45,65	14,83	45,59	15,03	45,52	15,23	45,45	15,43	48
49	46,60	15,14	46,54	15,35	46,47	15,55	46,40	15,75	49
50	47,55	15,45	47,48	15,66	47,42	15,87	47,35	16,07	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	72 Deg.		71¾ Deg.		71½ Deg.		71¼ Deg.		

Dist.	18 Deg. Lat.	18 Deg. Dep.	18¼ Deg. Lat.	18¼ Deg. Dep.	18½ Deg. Lat.	18½ Deg. Dep.	18¾ Deg. Lat.	18¾ Deg. Dep.	Dist.
51	48,50	15,76	48,43	15,97	48,36	16,18	48,29	16,39	51
52	49,45	16,07	49,38	16,28	49,31	16,50	49,24	16,71	52
53	50,41	16,38	50,33	16,60	50,26	16,82	50,19	17,04	53
54	51,36	16,69	51,28	16,91	51,21	17,13	51,13	17,36	54
55	52,31	17,00	52,23	17,22	52,16	17,45	52,08	17,68	55
56	53,26	17,30	53,18	17,54	53,11	17,77	53,03	18,00	56
57	54,21	17,61	54,13	17,85	54,05	18,09	53,98	18,32	57
58	55,16	17,92	55,08	18,16	55,00	18,40	54,92	18,64	58
59	56,11	18,23	56,03	18,48	55,95	18,72	55,87	18,96	59
60	57,06	18,54	56,98	18,79	56,90	19,04	56,82	19,29	60
61	58,01	18,85	57,93	19,10	57,85	19,36	57,76	19,61	61
62	58,97	19,16	58,88	19,42	58,80	19,67	58,71	19,93	62
63	59,92	19,47	59,83	19,73	59,74	19,99	59,66	20,25	63
64	60,87	19,78	60,78	20,04	60,69	20,31	60,60	20,57	64
65	61,82	20,09	61,73	20,36	61,64	20,62	61,55	20,89	65
66	62,77	20,40	62,68	20,67	62,59	20,94	62,50	21,22	66
67	63,72	20,70	63,63	20,98	63,54	21,26	63,44	21,54	67
68	64,67	21,01	64,58	21,30	64,49	21,58	64,39	21,86	68
69	65,62	21,32	65,53	21,61	65,43	21,89	65,34	22,18	69
70	66,57	21,63	66,48	21,92	66,38	22,21	66,29	22,50	70
71	67,53	21,94	67,43	22,23	67,33	22,53	67,23	22,82	71
72	68,48	22,25	68,38	22,55	68,28	22,85	68,18	23,14	72
73	69,43	22,56	69,33	22,86	69,23	23,16	69,13	23,47	73
74	70,38	22,87	70,28	23,17	70,18	23,48	70,07	23,79	74
75	71,33	23,18	71,23	23,49	71,12	23,80	71,02	24,11	75
76	72,28	23,49	72,18	23,80	72,07	24,12	71,97	24,43	76
77	73,23	23,79	73,13	24,11	73,02	24,43	72,91	24,75	77
78	74,18	24,10	74,08	24,43	73,97	24,75	73,86	25,07	78
79	75,13	24,41	75,03	24,74	74,92	25,07	74,81	25,39	79
80	76,08	24,72	75,98	25,05	75,87	25,38	75,75	25,72	80
81	77,04	25,03	76,93	25,37	76,81	25,70	76,70	26,04	81
82	77,99	25,34	77,88	25,68	77,76	26,02	77,65	26,36	82
83	78,94	25,65	78,83	25,99	78,71	26,34	78,60	26,68	83
84	79,89	25,96	79,77	26,31	79,66	26,65	79,54	27,00	84
85	80,84	26,27	80,72	26,62	80,61	26,97	80,49	27,32	85
86	81,79	26,58	81,67	26,93	81,56	27,29	81,44	27,64	86
87	82,74	26,88	82,62	27,25	82,50	27,61	82,38	27,97	87
88	83,69	27,19	83,57	27,56	83,45	27,92	83,33	28,29	88
89	84,64	27,50	84,52	27,87	84,40	28,24	84,28	28,61	89
90	85,60	27,81	85,47	28,18	85,35	28,56	85,22	28,93	90
91	86,55	28,12	86,42	28,50	86,30	28,87	86,17	29,25	91
92	87,50	28,43	87,37	28,81	87,25	29,19	87,12	29,57	92
93	88,45	28,74	88,32	29,12	88,19	29,51	88,06	29,89	93
94	89,40	29,05	89,27	29,44	89,14	29,83	89,01	30,22	94
95	90,35	29,36	90,22	29,75	90,09	30,14	89,96	30,54	95
96	91,30	29,67	91,17	30,06	91,04	30,46	90,91	30,86	96
97	92,25	29,97	92,12	30,38	91,99	30,78	91,85	31,18	97
98	93,20	30,28	93,07	30,69	92,94	31,10	92,80	31,50	98
99	94,15	30,59	94,02	31,00	93,88	31,41	93,75	31,82	99
100	95,11	30,90	94,97	31,32	94,83	31,73	94,69	32,14	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	72 Deg.		71¾ Deg.		71½ Deg.		71¼ Deg.		

Dist.	19 Deg. Lat.	19 Deg. Dep.	19¼ Deg. Lat.	19¼ Deg. Dep.	19½ Deg. Lat.	19½ Deg. Dep.	19¾ Deg. Lat.	19¾ Deg. Dep.	Dist.
1	0,95	0,33	0,94	0,33	0,94	0,33	0,94	0,34	1
2	1,89	0,65	1,89	0,66	1,89	0,67	1,88	0,68	2
3	2,84	0,98	2,83	0,99	2,83	1,00	2,82	1,01	3
4	3,78	1,30	3,78	1,32	3,77	1,34	3,76	1,35	4
5	4,73	1,63	4,72	1,65	4,71	1,67	4,71	1,69	5
6	5,67	1,95	5,66	1,98	5,66	2,00	5,65	2,03	6
7	6,62	2,28	6,61	2,31	6,60	2,34	6,59	2,37	7
8	7,56	2,60	7,55	2,64	7,54	2,67	7,53	2,70	8
9	8,51	2,93	8,50	2,97	8,48	3,00	8,47	3,04	9
10	9,46	3,26	9,44	3,30	9,43	3,34	9,41	3,38	10
11	10,40	3,58	10,38	3,63	10,37	3,67	10,35	3,72	11
12	11,35	3,91	11,33	3,96	11,31	4,01	11,29	4,06	12
13	12,29	4,23	12,27	4,29	12,25	4,34	12,24	4,39	13
14	13,24	4,56	13,22	4,62	13,20	4,67	13,18	4,73	14
15	14,18	4,88	14,16	4,95	14,14	5,01	14,12	5,07	15
16	15,13	5,21	15,11	5,28	15,08	5,34	15,06	5,41	16
17	16,07	5,53	16,05	5,60	16,02	5,67	16,00	5,74	17
18	17,02	5,86	16,99	5,93	16,97	6,01	16,94	6,08	18
19	17,96	6,19	17,94	6,26	17,91	6,34	17,88	6,42	19
20	18,91	6,51	18,88	6,59	18,85	6,68	18,82	6,76	20
21	19,86	6,84	19,83	6,92	19,80	7,01	19,76	7,10	21
22	20,80	7,16	20,77	7,25	20,74	7,34	20,71	7,43	22
23	21,75	7,49	21,71	7,58	21,68	7,68	21,65	7,77	23
24	22,69	7,81	22,66	7,91	22,62	8,01	22,59	8,11	24
25	23,64	8,14	23,60	8,24	23,57	8,35	23,53	8,45	25
26	24,58	8,46	24,55	8,57	24,51	8,68	24,47	8,79	26
27	25,53	8,79	25,49	8,90	25,45	9,01	25,41	9,12	27
28	26,47	9,12	26,43	9,23	26,39	9,35	26,35	9,46	28
29	27,42	9,44	27,38	9,56	27,34	9,68	27,29	9,80	29
30	28,37	9,77	28,32	9,89	28,28	10,01	28,24	10,14	30
31	29,31	10,09	29,27	10,22	29,22	10,35	29,18	10,48	31
32	30,26	10,42	30,21	10,55	30,16	10,68	30,12	10,81	32
33	31,20	10,74	31,15	10,88	31,11	11,02	31,06	11,15	33
34	32,15	11,07	32,10	11,21	32,05	11,35	32,00	11,49	34
35	33,09	11,39	33,04	11,54	32,99	11,68	32,94	11,83	35
36	34,04	11,72	33,99	11,87	33,94	12,02	33,88	12,17	36
37	34,98	12,05	34,93	12,20	34,88	12,35	34,82	12,50	37
38	35,93	12,37	35,88	12,53	35,82	12,68	35,76	12,84	38
39	36,88	12,70	36,82	12,86	36,76	13,02	36,71	13,18	39
40	37,82	13,02	37,76	13,19	37,71	13,35	37,65	13,52	40
41	38,77	13,35	38,71	13,52	38,65	13,69	38,59	13,85	41
42	39,71	13,67	39,65	13,85	39,59	14,02	39,53	14,19	42
43	40,66	14,00	40,60	14,18	40,53	14,35	40,47	14,53	43
44	41,60	14,32	41,54	14,51	41,48	14,69	41,41	14,87	44
45	42,55	14,65	42,48	14,84	42,42	15,02	42,35	15,21	45
46	43,49	14,98	43,43	15,17	43,36	15,36	43,29	15,54	46
47	44,4[illegible]	15,30	44,37	15,50	44,30	15,69	44,24	15,88	47
48	45,38	15,63	45,32	15,83	45,25	16,02	45,18	16,22	48
49	46,3[illegible]	15,95	46,26	16,15	46,19	16,36	46,12	16,56	49
50	47,2[illegible]	16,28	47,20	16,48	47,13	16,69	47,06	16,90	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	71 Deg.		70¾ Deg.		70½ Deg.		70¼ Deg.		

Dist.	19 Deg. Lat.	19 Deg. Dep.	19¼ Deg. Lat.	19¼ Deg. Dep.	19½ Deg. Lat.	19½ Deg. Dep.	19¾ Deg. Lat.	19¾ Deg. Dep.	Dist.
51	48,22	16,60	48,15	16,81	48,07	17,02	48,00	17,23	51
52	49,17	16,93	49,09	17,14	49,02	17,36	48,94	17,57	52
53	50,11	17,26	50,04	17,47	49,96	17,69	49,88	17,91	53
54	51,06	17,58	50,98	17,80	50,90	18,03	50,82	18,25	54
55	52,00	17,91	51,92	18,13	51,85	18,36	51,76	18,59	55
56	52,95	18,23	52,87	18,46	52,79	18,69	52,71	18,92	56
57	53,89	18,56	53,81	18,79	53,73	19,03	53,65	19,26	57
58	54,84	18,88	54,76	19,12	54,67	19,36	54,59	19,60	58
59	55,79	19,21	55,70	19,45	55,62	19,69	55,53	19,94	59
60	56,73	19,53	56,65	19,78	56,56	20,03	56,47	20,27	60
61	57,68	19,86	57,59	20,11	57,50	20,36	57,41	20,61	61
62	58,62	20,19	58,53	20,44	58,44	20,70	58,35	20,95	62
63	59,57	20,51	59,48	20,77	59,39	21,03	59,29	21,29	63
64	60,51	20,84	60,42	21,10	60,33	21,36	60,24	21,63	64
65	61,46	21,16	61,37	21,43	61,27	21,70	61,18	21,96	65
66	62,40	21,49	62,31	21,76	62,21	22,03	62,12	22,30	66
67	63,35	21,81	63,25	22,09	63,16	22,37	63,06	22,64	67
68	64,30	22,14	64,20	22,42	64,10	22,70	64,00	22,98	68
69	65,24	22,46	65,14	22,75	65,04	23,03	64,94	23,32	69
70	66,19	22,79	66,09	23,08	65,98	23,37	65,88	23,65	70
71	67,13	23,12	67,03	23,41	66,93	23,70	66,82	23,99	71
72	68,08	23,44	67,97	23,74	67,87	24,03	67,76	24,33	72
73	69,02	23,77	68,92	24,07	68,81	24,37	68,71	24,67	73
74	69,97	24,09	69,86	24,40	69,76	24,70	69,65	25,01	74
75	70,91	24,42	70,81	24,73	70,70	25,04	70,59	25,34	75
76	71,86	24,74	71,75	25,06	71,64	25,37	71,53	25,68	76
77	72,80	25,07	72,69	25,39	72,58	25,70	72,47	25,02	77
78	73,75	25,39	73,64	25,72	73,53	26,04	73,41	26,36	78
79	74,70	25,72	74,58	26,05	74,47	26,37	74,35	26,70	79
80	75,64	26,05	75,53	26,38	75,41	26,70	75,29	27,03	80
81	76,59	26,37	76,47	26,70	76,35	27,04	76,24	27,37	81
82	77,53	26,70	77,42	27,03	77,30	27,37	77,18	27,71	82
83	78,48	27,02	78,36	27,36	78,24	27,71	78,12	28,05	83
84	79,42	27,35	79,30	27,69	79,18	28,04	79,06	28,39	84
85	80,37	27,67	80,25	28,02	80,12	28,37	80,00	28,72	85
86	81,31	28,00	81,19	28,35	81,07	28,71	80,94	29,06	86
87	82,26	28,32	82,14	28,68	82,01	29,04	81,88	29,40	87
88	83,21	28,65	83,08	29,01	82,95	29,37	82,82	29,74	88
89	84,15	28,98	84,02	29,34	83,90	29,71	83,76	30,07	89
90	85,10	29,30	84,97	29,67	84,84	30,04	84,71	30,41	90
91	86,04	29,63	85,91	30,00	85,78	30,38	85,65	30,75	91
92	86,99	29,95	86,86	30,33	86,72	30,71	86,59	31,09	92
93	87,93	30,28	87,80	30,66	87,67	31,04	87,53	31,43	93
94	88,88	30,60	88,74	30,99	88,61	31,38	88,47	31,76	94
95	89,82	30,93	89,69	31,32	89,55	31,71	89,41	32,10	95
96	90,77	31,25	90,63	31,65	90,49	32,05	90,35	32,44	96
97	91,72	31,58	91,58	31,98	91,44	32,38	91,29	32,78	97
98	92,66	31,91	92,52	32,31	92,38	32,71	92,24	33,12	98
99	93,61	32,23	93,46	32,64	93,32	33,05	93,18	33,45	99
100	94,55	32,56	94,41	32,97	94,26	33,38	94,12	33,79	100
Dist.	Dep.	Lat.	Dep	Lat.	Dep.	Lat.	Dep	Lat	Dist.
	71 Deg.		70¾ Deg.		70½ Deg.		70¼ Deg.		

Dist.	20 Deg.		20¼ Deg.		20½ Deg.		20¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,94	0,34	0,94	0,35	0,94	0,35	0,94	0,35	1
2	1,88	0,68	1,88	0,69	1,87	0,70	1,87	0,71	2
3	2,82	1,03	2,81	1,04	2,81	1,05	2,81	1,06	3
4	3,76	1,37	3,75	1,38	3,75	1,40	3,74	1,42	4
5	4,70	1,71	4,69	1,73	4,68	1,75	4,68	1,77	5
6	5,64	2,05	5,63	2,08	5,62	2,10	5,61	2,13	6
7	6,58	2,39	6,57	2,42	6,56	2,45	6,55	2,48	7
8	7,52	2,74	7,51	2,77	7,49	2,80	7,48	2,83	8
9	8,46	3,08	8,44	3,12	8,43	3,15	8,42	3,19	9
10	9,40	3,42	9,38	3,46	9,37	3,50	9,35	3,54	10
11	10,34	3,76	10,32	3,81	10,30	3,85	10,29	3,90	11
12	11,28	4,10	11,26	4,15	11,24	4,20	11,22	4,25	12
13	12,22	4,45	12,20	4,50	12,18	4,55	12,16	4,61	13
14	13,16	4,79	13,13	4,85	13,11	4,90	13,09	4,96	14
15	14,10	5,13	14,07	5,19	14,05	5,25	14,03	5,31	15
16	15,04	5,47	15,01	5,54	14,99	5,60	14,96	5,67	16
17	15,97	5,81	15,95	5,88	15,92	5,95	15,90	6,02	17
18	16,91	6,16	16,89	6,23	16,86	6,30	16,83	6,38	18
19	17,85	6,50	17,83	6,58	17,80	6,65	17,77	6,73	19
20	18,79	6,84	18,76	6,92	18,73	7,00	18,70	7,09	20
21	19,73	7,18	19,70	7,27	19,67	7,35	19,64	7,44	21
22	20,67	7,52	20,64	7,61	20,61	7,70	20,57	7,79	22
23	21,61	7,87	21,58	7,96	21,54	8,05	21,51	8,15	23
24	22,55	8,21	22,52	8,31	22,48	8,40	22,44	8,50	24
25	23,49	8,55	23,45	8,65	23,42	8,76	23,38	8,86	25
26	24,43	8,89	24,39	9,00	24,35	9,11	24,31	9,21	26
27	25,37	9,23	25,33	9,35	25,29	9,46	25,25	9,57	27
28	26,31	9,58	26,27	9,69	26,23	9,81	26,18	9,92	28
29	27,25	9,92	27,21	10,04	27,16	10,16	27,12	10,27	29
30	28,19	10,26	28,15	10,38	28,10	10,51	28,05	10,63	30
31	29,13	10,60	29,08	10,73	29,04	10,86	28,99	10,98	31
32	30,07	10,94	30,02	11,08	29,97	11,21	29,92	11,34	32
33	31,01	11,29	30,96	11,42	30,91	11,56	30,86	11,69	33
34	31,95	11,63	31,90	11,77	31,85	11,91	31,79	12,05	34
35	32,89	11,97	32,84	12,11	32,78	12,26	32,73	12,40	35
36	33,83	12,31	33,77	12,46	33,72	12,61	33,66	12,75	36
37	34,77	12,65	34,71	12,81	34,66	12,96	34,60	13,11	37
38	35,71	13,00	35,65	13,15	35,59	13,31	35,54	13,46	38
39	36,65	13,34	36,59	13,50	36,53	13,66	36,47	13,82	39
40	37,59	13,68	37,53	13,84	37,47	14,01	37,41	14,17	40
41	38,53	14,02	38,47	14,19	38,40	14,36	38,34	14,53	41
42	39,47	14,36	39,40	14,54	39,34	14,71	39,28	14,88	42
43	40,41	14,71	40,34	14,88	40,28	15,06	40,21	15,23	43
44	41,35	15,05	41,28	15,23	41,21	15,41	41,15	15,59	44
45	42,29	15,39	42,22	15,58	42,15	15,76	42,08	15,94	45
46	43,23	15,73	43,16	15,92	43,09	16,11	43,02	16,30	46
47	44,17	16,07	44,09	16,27	44,02	16,46	43,95	16,65	47
48	45,11	16,42	45,03	16,61	44,96	16,81	44,89	17,01	48
49	46,04	16,76	45,97	16,96	45,90	17,16	45,82	17,36	49
50	46,98	17,10	46,91	17,31	46,83	17,51	46,76	17,71	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	70 Deg.		69¾ Deg.		69½ Deg.		69¼ Deg.		

Dist.	20 Deg. Lat.	20 Deg. Dep.	20¼ Deg. Lat.	20¼ Deg. Dep.	20½ Deg. Lat.	20½ Deg. Dep.	20¾ Deg. Lat.	20¾ Deg. Dep.	Dist.
51	47,92	17,44	47,85	17,65	47,77	17,86	47,69	18,07	51
52	48,86	17,79	48,79	18,00	48,71	18,21	48,63	18,42	52
53	49,80	18,13	49,72	18,34	49,64	18,56	49,56	18,78	53
54	50,74	18,47	50,66	18,69	50,58	18,91	50,50	19,13	54
55	51,68	18,81	51,60	19,04	51,52	19,26	51,43	19,49	55
56	52,62	19,15	52,54	19,38	52,45	19,61	52,37	19,84	56
57	53,56	19,50	53,48	19,73	53,39	19,96	53,30	20,19	57
58	54,50	19,84	54,42	20,07	54,33	20,31	54,24	20,55	58
59	55,44	20,18	55,35	20,42	55,26	20,66	55,17	20,90	59
60	56,38	20,52	56,29	20,77	56,20	21,01	56,11	21,26	60
61	57,32	20,86	57,23	21,11	57,14	21,36	57,04	21,61	61
62	58,26	21,21	58,17	21,46	58,07	21,71	57,98	21,97	62
63	59,20	21,55	59,11	21,81	59,01	22,06	58,91	22,32	63
64	60,14	21,89	60,04	22,15	59,95	22,41	59,85	22,67	64
65	61,08	22,23	60,98	22,50	60,88	22,76	60,78	23,03	65
66	62,02	22,57	61,92	22,84	61,82	23,11	61,72	23,38	66
67	62,96	22,92	62,86	23,19	62,76	23,46	62,65	23,74	67
68	63,90	23,26	63,80	23,54	63,69	23,81	63,59	24,09	68
69	64,84	23,60	64,74	23,88	64,63	24,16	64,52	24,45	69
70	65,78	23,94	65,67	24,23	65,57	24,51	65,46	24,80	70
71	66,72	24,28	66,61	24,57	66,50	24,86	66,39	25,15	71
72	67,66	24,63	67,55	24,92	67,44	25,21	67,33	25,51	72
73	68,60	24,97	68,49	25,27	68,38	25,57	68,26	25,86	73
74	69,54	25,31	69,43	25,61	69,31	25,92	69,20	26,22	74
75	70,48	25,65	70,36	25,96	70,25	26,27	70,14	26,57	75
76	71,42	25,99	71,30	26,30	71,19	26,62	71,07	26,93	76
77	72,36	26,34	72,24	26,65	72,12	26,97	72,01	27,28	77
78	73,30	26,68	73,18	27,00	73,06	27,32	72,94	27,63	78
79	74,24	27,02	74,12	27,34	74,00	27,67	73,88	27,99	79
80	75,18	27,36	75,06	27,69	74,93	28,02	74,81	28,34	80
81	76,12	27,70	75,99	28,04	75,87	28,37	75,75	28,70	81
82	77,05	28,05	76,93	28,38	76,81	28,72	76,68	29,05	82
83	77,99	28,39	77,87	28,73	77,74	29,07	77,62	29,41	83
84	78,93	28,73	78,81	29,07	78,68	29,42	78,55	29,76	84
85	79,87	29,07	79,75	29,42	79,62	29,77	79,49	30,11	85
86	80,81	29,41	80,68	29,77	80,55	30,12	80,42	30,47	86
87	81,75	29,76	81,62	30,11	81,49	30,47	81,36	30,82	87
88	82,69	30,10	82,56	30,46	82,43	30,82	82,29	31,18	88
89	83,63	30,44	83,50	30,80	83,36	31,17	83,23	31,53	89
90	84,57	30,78	84,44	31,15	84,30	31,52	84,16	31,89	90
91	85,51	31,12	85,38	31,50	85,24	31,87	85,10	32,24	91
92	86,45	31,47	86,31	31,84	86,17	32,22	86,03	32,59	92
93	87,39	31,81	87,25	32,19	87,11	32,57	86,97	32,95	93
94	88,33	32,15	88,19	32,54	88,05	32,92	87,90	33,30	94
95	89,27	32,49	89,13	32,88	88,98	33,27	88,84	33,66	95
96	90,21	32,83	90,07	33,23	89,92	33,62	89,77	34,01	96
97	91,15	33,18	91,00	33,57	90,86	33,97	90,71	34,37	97
98	92,09	33,52	91,94	33,92	91,79	34,32	91,64	34,72	98
99	93,03	33,86	92,88	34,27	92,73	34,67	92,58	35,07	99
100	93,97	34,20	93,82	34,61	93,67	35,02	93,51	35,43	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep	Lat.	Dist.
	70 Deg.		69¾ Deg.		69½ Deg.		69¼ Deg.		

Dist.	21 Deg.		21¼ Deg.		21½ Deg.		21¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,93	0,36	0,93	0,36	0,93	0,37	0,93	0,37	1
2	1,87	0,72	1,86	0,72	1,86	0,73	1,86	0,74	2
3	2,80	1,08	2,80	1,09	2,79	1,10	2,79	1,11	3
4	3,73	1,43	3,73	1,45	3,72	1,47	3,72	1,48	4
5	4,67	1,79	4,66	1,81	4,65	1,83	4,64	1,85	5
6	5,60	2,15	5,59	2,17	5,58	2,20	5,57	2,22	6
7	6,54	2,51	6,52	2,54	6,51	2,57	6,50	2,59	7
8	7,47	2,87	7,46	2,90	7,44	2,93	7,43	2,96	8
9	8,40	3,23	8,39	3,26	8,37	3,30	8,36	3,34	9
10	9,34	3,58	9,32	3,62	9,30	3,67	9,29	3,71	10
11	10,27	3.94	10,25	3,99	10,23	4,03	10,22	4,08	11
12	11,20	4,30	11,18	4,35	11,17	4,40	11,15	4,45	12
13	12,14	4,66	12,12	4,71	12,10	4,76	12,07	4,82	13
14	13,07	5,02	13,05	5,07	13,03	5,13	13,00	5,19	14
15	14,00	5,38	13,98	5,44	13,96	5,50	13,93	5,56	15
16	14,94	5,73	14,91	5,80	14,89	5,86	14,86	5,93	16
17	15,87	6,09	15,84	6,16	15,82	6,23	15,79	6,30	17
18	16,80	6,45	16,78	6,52	16,75	6,60	16,72	6,67	18
19	17,74	6,81	17,71	6,89	17,68	6,96	17,65	7,04	19
20	18,67	7,17	18,64	7,25	18,61	7,33	18,58	7,41	20
21	19,61	7,53	19,57	7,61	19,54	7,70	19,50	7,78	21
22	20,54	7,88	20,50	7,97	20,47	8,06	20,43	8,15	22
23	21,47	8,24	21,44	8,34	21,40	8,43	21,36	8,52	23
24	22,41	8,60	22,37	8,70	22,33	8,80	22,29	8,89	24
25	23,34	8,96	23,30	9,06	23,26	9,16	23,22	9,26	25
26	24,27	9,32	24,23	9,42	24,19	9,53	24,15	9,63	26
27	25,21	9,68	25,16	9,79	25,12	9,90	25,08	10,01	27
28	26,14	10,03	26,10	10,15	26,05	10,26	26,01	10,38	28
29	27,07	10,39	27,03	10,51	26,98	10,63	26,94	10,75	29
30	28,01	10,75	27,96	10,87	27,91	11,00	27,86	11,12	30
31	28,94	11,11	28,89	11,24	28,84	11,36	28,79	11,49	31
32	29,87	11,47	29,82	11,60	29,77	11,73	29,72	11,86	32
33	30,81	11,83	30,76	11,96	30,70	12,09	30,65	12,23	33
34	31,74	12,18	31,69	12,32	31,63	12,46	31,58	12,60	34
35	32,68	12,54	32,62	12,69	32,56	12,83	32,51	12,97	35
36	33,61	12,90	33,55	13,05	33,50	13,19	33,44	13,34	36
37	34,54	13,26	34,48	13,41	34,43	13,56	34,37	13,71	37
38	35,48	13,62	35,42	13,77	35,36	13,93	35,29	14,08	38
39	36,41	13,98	36,35	14,14	36,29	14,29	36,22	14,45	39
40	37,34	14,33	37,28	14,50	37,22	14,66	37,15	14,82	40
41	38,28	14,69	38,21	14,86	38,15	15,03	38,08	15,19	41
42	39,21	15,05	39.14	15,22	39,08	15,39	39,01	15,56	42
43	40,14	15,41	40.08	15,58	40,01	15,76	39,94	15,93	43
44	41,08	15,77	41,01	15,95	40,94	16,13	40,87	16,30	44
45	42,01	16,13	41,94	16,31	41,87	16,49	41,80	16,68	45
46	42,94	16,48	42,87	16,67	42,80	16,86	42,73	17,05	46
47	43,88	16,84	43,80	17,03	43,73	17,23	43,65	17,42	47
48	44,81	17,20	44,74	17,40	44,66	17,59	44,58	17,79	48
49	45,75	17,56	45,67	17,76	45,59	17,96	45,51	18,16	49
50	46,68	17.92	46,60	18,12	46,52	18,33	46,44	18,53	50
Dist.	Dep	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	69 Deg.		68¾ Deg.		68½ Deg.		68¼ Deg.		

Dist.	21 Deg. Lat.	21 Deg. Dep.	21¼ Deg. Lat.	21¼ Deg. Dep.	21½ Deg. Lat.	21½ Deg. Dep.	21¾ Deg. Lat.	21¾ Deg. Dep.	Dist.
51	47,61	18,28	47,53	18,48	47,45	18,69	47,37	18,90	51
52	48,55	18,64	48,46	18,85	48,38	19,06	48,30	19,27	52
53	49,48	18,99	49,40	19,21	49,31	19,42	49,23	19,64	53
54	50,41	19,35	50,33	19,57	50,24	19,79	50,16	20,01	54
55	51,35	19,71	51,26	19,93	51,17	20,16	51,08	20,38	55
56	52,28	20,07	52,19	20,30	52,10	20,52	52,01	20,75	56
57	53,21	20,43	53,12	20,66	53,03	20,89	52,94	21,12	57
58	54,15	20,79	54,06	21,02	53,96	21,26	53,87	21,49	58
59	55,08	21,14	54,99	21,38	54,89	21,62	54,80	21,86	59
60	56,01	21,50	55,92	21,75	55,83	21,99	55,73	22,23	60
61	56,95	21,86	56,85	22,11	56,76	22,36	56,66	22,60	61
62	57,88	22,22	57,78	22,47	57,69	22,72	57,59	22,97	62
63	58,82	22,58	58,72	22,83	58,62	23,09	58,52	23,35	63
64	59,75	22,94	59,65	23,20	59,55	23,46	59,44	23,72	64
65	60,68	23,29	60,58	23,56	60,48	23,82	60,37	24,09	65
66	61,62	23,65	61,51	23,92	61,41	24,19	61,30	24,46	66
67	62,55	24,01	62,44	24,28	62,34	24,56	62,23	24,83	67
68	63,48	24,37	63,38	24,65	63,27	24,92	63,16	25,20	68
69	64,42	24,73	64,31	25,01	64,20	25,29	64,09	25,57	69
70	65,35	25,09	65,24	25,37	65,13	25,66	65,02	25,94	70
71	66,28	25,44	66,17	25,73	66,06	26,02	65,95	26,31	71
72	67,22	25,80	67,10	26,10	66,99	26,39	66,87	26,68	72
73	68,15	26,16	68,04	26,46	67,92	26,75	67,80	27,05	73
74	69,08	26,52	68,97	26,82	68,85	27,12	68,73	27,42	74
75	70,02	26,88	69,90	27,18	69,78	27,49	69,66	27,79	75
76	70,95	27,24	70,83	27,55	70,71	27,85	70,59	28,16	76
77	71,89	27,59	71,76	27,91	71,64	28,22	71,52	28,53	77
78	72,82	27,95	72,70	28,27	72,57	28,59	72,45	28,90	78
79	73,75	28,31	73,63	28,63	73,50	28,95	73,38	29,27	79
80	74,69	28,67	74,56	29,00	74,43	29,32	74,30	29,64	80
81	75,62	29,03	75,49	29,36	75,36	29,69	75,23	30,02	81
82	76,55	29,39	76,42	29,72	76,29	30,05	76,16	30,39	82
83	77,49	29,74	77,36	30,08	77,22	30,42	77,09	30,76	83
84	78,42	30,10	78,29	30,44	78,16	30,79	78,02	31,13	84
85	79,35	30,46	79,22	30,81	79,09	31,15	78,95	31,50	85
86	80,29	30,82	80,15	31,17	80,02	31,52	79,88	31,87	86
87	81,22	31,18	81,08	31,53	80,95	31,89	80,81	32,24	87
88	82,16	31,54	82,02	31,89	81,88	32,25	81,74	32,61	88
89	83,09	31,89	82,95	32,26	82,81	32,62	82,66	32,98	89
90	84,02	32,25	83,88	32,62	83,74	32,99	83,59	33,35	90
91	84,96	32,61	84,81	32,98	84,67	33,35	84,52	33,72	91
92	85,89	32,97	85,74	33,34	85,60	33,72	85,45	34,09	92
93	86,82	33,33	86,68	33,71	86,53	34,08	86,38	34,46	93
94	87,76	33,69	87,61	34,07	87,46	34,45	87,31	34,83	94
95	88,69	34,04	88,54	34,43	88,39	34,82	88,24	35,20	95
96	89,62	34,40	89,47	34,79	89,32	35,18	89,17	35,57	96
97	90,56	34,76	90,40	35,16	90,25	35,55	90,09	35,94	97
98	91,49	35,12	91,34	35,52	91,18	35,92	91,02	36,31	98
99	92,42	35,48	92,27	35,88	92,11	36,28	91,95	36,69	99
100	93,36	35,84	93,20	36,24	93,04	36,65	92,88	37,06	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep	Lat.	Dist.
	69 Deg.		68¾ Deg.		68½ Deg.		68¼ Deg.		

Dist.	22 Deg.		22¼ Deg.		22½ Deg.		22¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,93	0,37	0,93	0,38	0,92	0,38	0,92	0,39	1
2	1,85	0,75	1,85	0,76	1,85	0,77	1,84	0,77	2
3	2,78	1,12	2,78	1,14	2,77	1,15	2,77	1,16	3
4	3,71	1,50	3,70	1,51	3,70	1,53	3,69	1,55	4
5	4,64	1,87	4,63	1,89	4,62	1,91	4,61	1,93	5
6	5,56	2,25	5,55	2,27	5,54	2,30	5,53	2,32	6
7	6,49	2,62	6,48	2,65	6,47	2,68	6,46	2,71	7
8	7,42	3,00	7,40	3,03	7,39	3,06	7,38	3,09	8
9	8,34	3,37	8,33	3,41	8,31	3,44	8,30	3,48	9
10	9,27	3,75	9,26	3,79	9,24	3,83	9,22	3,87	10
11	10,20	4,12	10,18	4,17	10,16	4,21	10,14	4,25	11
12	11,13	4,50	11,11	4,54	11,09	4,59	11,07	4,64	12
13	12,05	4,87	12,03	4,92	12,01	4,97	11,99	5,03	13
14	12,98	5,24	12,96	5,30	12,93	5,36	12,91	5,41	14
15	13,91	5,62	13,88	5,68	13,86	5,74	13,83	5,80	15
16	14,83	5,99	14,81	6,06	14,78	6,12	14,76	6,19	16
17	15,76	6,37	15,73	6,44	15,71	6,51	15,68	6,57	17
18	16,69	6,74	16,66	6,82	16,63	6,89	16,60	6,96	18
19	17,62	7,12	17,59	7,19	17,55	7,27	17,52	7,35	19
20	18,54	7,49	18,51	7,57	18,48	7,65	18,44	7,73	20
21	19,47	7,87	19,44	7,95	19,40	8,04	19,37	8,12	21
22	20,40	8,24	20,36	8,33	20,33	8,42	20,29	8,51	22
23	21,33	8,62	21,29	8,71	21,25	8,80	21,21	8,89	23
24	22,25	8,99	22,21	9,09	22,17	9,18	22,13	9,28	24
25	23,18	9,37	23,14	9,47	23,10	9,57	23,05	9,67	25
26	24,11	9,74	24,06	9,84	24,02	9,95	23,98	10,05	26
27	25,03	10,11	24,99	10,22	24,94	10,33	24,90	10,44	27
28	25,96	10,49	25,92	10,60	25,87	10,72	25,82	10,83	28
29	26,89	10,86	26,84	10,98	26,79	11,10	26,74	11,21	29
30	27,82	11,24	27,77	11,36	27,72	11,48	27,67	11,60	30
31	28,74	11,61	28,69	11,74	28,64	11,86	28,59	11,99	31
32	29,67	11,99	29,62	12,12	29,56	12,25	29,51	12,37	32
33	30,60	12,36	30,54	12,50	30,49	12,63	30,43	12,76	33
34	31,52	12,74	31,47	12,87	31,41	13,01	31,35	13,15	34
35	32,45	13,11	32,39	13,25	32,34	13,39	32,28	13,53	35
36	33,38	13,49	33,32	13,63	33,26	13,78	33,20	13,92	36
37	34,31	13,86	34,24	14,01	34,18	14,16	34,12	14,31	37
38	35,23	14,24	35,17	14,39	35,11	14,54	35,04	14,70	38
39	36,16	14,61	36,10	14,77	36,03	14,92	35,97	15,08	39
40	37,09	14,98	37,02	15,15	36,96	15,31	36,89	15,47	40
41	38,01	15,36	37,95	15,52	37,88	15,69	37,81	15,86	41
42	38,94	15,73	38,87	15,90	38,80	16,07	38,73	16,24	42
43	39,87	16,11	39,80	16,28	39,73	16,46	39,65	16,63	43
44	40,80	16,48	40,72	16,66	40,65	16,84	40,58	17,02	44
45	41,72	16,86	41,65	17,04	41,57	17,22	41,50	17,40	45
46	42,65	17,23	42,57	17,42	42,50	17,60	42,42	17,79	46
47	43,58	17,61	43,50	17,80	43,42	17,99	43,34	18,18	47
48	44,50	17,98	44,43	18,18	44,35	18,37	44,27	18,56	48
49	45,43	18,36	45,35	18,55	45,27	18,75	45,19	18,95	49
50	46,36	18,73	46,28	18,93	46,19	19,13	46,11	19,34	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	68 Deg.		67¾ Deg.		67½ Deg.		67¼ Deg.		

Dist.	22 Deg. Lat.	22 Deg. Dep.	22¼ Deg. Lat.	22¼ Deg. Dep.	22½ Deg. Lat.	22½ Deg. Dep.	22¾ Deg. Lat.	22¾ Deg. Dep.	Dist.
51	47,29	19,10	47,20	19,31	47,12	19,52	47,03	19,72	51
52	48,21	19,48	48,13	19,69	48,04	19,90	47,95	20,11	52
53	49,14	19,85	49,05	20,07	48,97	20,28	48,88	20,50	53
54	50,07	20,23	49,98	20,45	49,89	20,66	49,80	20,88	54
55	51,00	20,60	50,90	20,83	50,81	21,05	50,72	21,27	55
56	51,92	20,98	51,83	21,20	51,74	21,43	51,64	21,66	56
57	52,85	21,35	52,76	21,58	52,66	21,81	52,57	22,04	57
58	53,78	21,73	53,68	21,96	53,59	22,20	53,49	22,43	58
59	54,70	22,10	54,61	22,34	54,51	22,58	54,41	22,82	59
60	55,63	22,48	55,53	22,72	55,43	22,96	55,33	23,20	60
61	56,56	22,85	56,46	23,10	56,36	23,34	56,25	23,59	61
62	57,49	23,23	57,38	23,48	57,28	23,73	57,18	23,98	62
63	58,41	23,60	58,31	23,85	58,20	24,11	58,10	24,36	63
64	59,34	23,97	59,23	24,23	59,13	24,49	59,02	24,75	64
65	60,27	24,35	60,16	24,61	60,05	24,87	59,94	25,14	65
66	61,19	24,72	61,09	24,99	60,98	25,26	60,87	25,52	66
67	62,12	25,10	62,01	25,37	61,90	25,64	61,79	25,91	67
68	63,05	25,47	62,94	25,75	62,82	26,02	62,71	26,30	68
69	63,98	25,85	63,86	26,13	63,75	26,41	63,63	26,68	69
70	64,90	26,22	64,79	26,51	64,67	26,79	64,55	27,07	70
71	65,83	26,60	65,71	26,88	65,60	27,17	65,48	27,46	71
72	66,76	26,97	66,64	27,26	66,52	27,55	66,40	27,84	72
73	67,68	27,35	67,56	27,64	67,44	27,94	67,32	28,23	73
74	68,61	27,72	68,49	28,02	68,37	28,32	68,24	28,62	74
75	69,54	28,10	69,42	28.40	69,29	28,70	69,17	29,00	75
76	70,47	28,47	70,34	28,78	70,21	29,08	70,09	29,39	76
77	71,39	28,84	71,27	29,16	71,14	29,47	71,01	29,78	77
78	72,32	29,22	72,19	29,53	72,06	29,85	71,93	30,16	78
79	73,25	29,59	73,12	29,91	72,99	30,23	72,85	30,55	79
80	74,17	29,97	74,04	30,29	73,91	30,61	73,78	30,94	80
81	75,10	30,34	74,97	30,67	74,83	31,00	74,70	31,32	81
82	76,03	30,72	75,89	31,05	75,76	31,38	75,62	31,71	82
83	76,96	31,09	76,82	31,43	76,68	31,76	76,54	32,10	83
84	77,88	31,47	77,75	31,81	77,61	32,15	77,46	32,48	84
85	78,81	31,84	78,67	32,19	78,53	32,53	78,39	32,87	85
86	79,74	32,22	79,60	32,56	79,45	32,91	79,31	33,26	86
87	80,66	32,59	80,52	32,94	80,38	33,29	80,23	33,64	87
88	81,59	32,97	81,45	33,32	81,30	33,68	81,15	34,03	88
89	82,52	33,34	82,37	33,70	82,23	34,06	82,08	34,42	89
90	83.45	33,71	83,30	34,08	83,15	34,44	83,00	34,80	90
91	84,37	34,09	84,22	34,46	84,07	34,82	83,92	35,19	91
92	85,30	34,46	85,15	34,84	85,00	35,21	84,84	35,58	92
93	86,23	34,84	86,08	35,21	85,92	35,59	85,76	35,96	93
94	87,16	35,21	87,00	35,59	86,84	35,97	86,69	36,35	94
95	88,08	35,59	87,93	35,97	87,77	36,35	87,61	36,74	95
96	89,01	35,96	88,85	36,35	88,69	36,74	88,53	37,12	96
97	89,94	36,34	89,78	36,73	89,62	37,12	89,45	37,51	97
98	90,86	36,71	90,70	37,11	90,54	37,50	90,38	37,90	98
99	91,79	37,09	91,63	37,49	91,46	37,89	91,30	38,28	99
100	92,72	37,46	92,55	37,86	92,39	38,27	92,22	38,67	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep	Lat.	Dist.
	68 Deg.		67¾ Deg.		67½ Deg.		67¼ Deg.		

Dist.	23 Deg. Lat.	23 Deg. Dep.	23¼ Deg. Lat.	23¼ Deg. Dep.	23½ Deg. Lat.	23½ Deg. Dep.	23¾ Deg. Lat.	23¾ Deg. Dep.	Dist.
1	0,92	0,39	0,92	0,39	0,92	0,40	0,92	0,40	1
2	1,84	0,78	1,84	0,79	1,83	0,80	1,83	0,81	2
3	2,76	1,17	2,76	1,18	2,75	1,20	2,75	1,21	3
4	3,68	1,56	3,68	1,58	3,67	1,59	3,66	1,61	4
5	4,60	1,95	4,59	1,97	4,59	1,99	4,58	2,01	5
6	5,52	2,34	5,51	2,37	5,50	2,39	5,49	2,42	6
7	6,44	2,74	6,43	2,76	6,42	2,79	6,41	2,82	7
8	7,36	3,13	7,35	3,16	7,34	3,19	7,32	3,22	8
9	8,28	3,52	8,27	3,55	8,25	3,59	8,24	3,62	9
10	9,20	3,91	9,19	3,95	9,17	3,99	9,15	4,03	10
11	10,13	4,30	10,11	4,34	10,09	4,39	10,07	4,43	11
12	11,05	4,69	11,03	4,74	11,00	4,78	10,98	4,83	12
13	11,97	5,08	11,94	5,13	11,92	5,18	11,90	5,24	13
14	12,89	5,47	12,86	5,53	12,84	5,58	12,81	5,64	14
15	13,81	5,86	13,78	5,92	13,76	5,98	13,73	6,04	15
16	14,73	6,25	14,70	6,32	14,67	6,38	14,64	6,44	16
17	15,65	6,64	15,62	6,71	15,59	6,78	15,56	6,85	17
18	16,57	7,03	16,54	7,11	16,51	7,18	16,48	7,25	18
19	17,49	7,42	17,46	7,50	17,42	7,58	17,39	7,65	19
20	18,41	7,81	18,38	7,89	18,34	7,97	18,31	8,05	20
21	19,33	8,21	19,29	8,29	19,26	8,37	19,22	8,46	21
22	20,25	8,60	20,21	8,68	20,18	8,77	20,14	8,86	22
23	21,17	8,99	21,13	9,08	21,09	9,17	21,05	9,26	23
24	22,09	9,38	22,05	9,47	22,01	9,57	21,97	9,67	24
25	23,01	9,77	22,97	9,87	22,93	9,97	22,88	10,07	25
26	23,93	10,16	23,89	10,26	23,84	10,37	23,80	10,47	26
27	24,85	10,55	24,81	10,66	24,76	10,77	24,71	10,87	27
28	25,77	10,94	25,73	11,05	25,68	11,16	25,63	11,28	28
29	26,69	11,33	26,64	11,45	26,59	11,56	26,54	11,68	29
30	27,62	11,72	27,56	11,84	27,51	11,96	27,46	12,08	30
31	28,54	12,11	28,48	12,24	28,43	12,36	28,37	12,49	31
32	29,46	12,50	29,40	12,63	29,35	12,76	29,29	12,89	32
33	30,38	12,89	30,32	13,03	30,26	13,16	30,21	13,29	33
34	31,30	13,28	31,24	13,42	31,18	13,56	31,12	13,69	34
35	32,22	13,68	32,16	13,82	32,10	13,96	32,04	14,10	35
36	33,14	14,07	33,08	14,21	33,01	14,35	32,95	14,50	36
37	34,06	14,46	34,00	14,61	33,93	14,75	33,87	14,90	37
38	34,98	14,85	34,91	15,00	34,85	15,15	34,78	15,30	38
39	35,90	15,24	35,83	15,39	35,77	15,55	35,70	15,71	39
40	36,82	15,63	36,75	15,79	36,68	15,95	36,61	16,11	40
41	37,74	16,02	37,67	16,18	37,60	16,35	37,53	16,51	41
42	38,66	16,41	38,59	16,58	38,52	16,75	38,44	16,92	42
43	39,58	16,80	39,51	16,97	39,43	17,15	39,36	17,32	43
44	40,50	17,19	40,43	17,37	40,35	17,54	40,27	17,72	44
45	41,42	17,58	41,35	17,76	41,27	17,94	41,19	18,12	45
46	42,34	17,97	42,26	18,16	42,18	18,34	42,10	18,53	46
47	43,26	18,36	43,18	18,55	43,10	18,74	43,02	18,93	47
48	44,18	18,76	44,10	18,95	44,02	19,14	43,93	19,33	48
49	45,10	19,15	45,02	19,34	44,94	19,54	44,85	19,73	49
50	46,03	19,54	45,94	19,74	45,85	19,94	45,77	20,14	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	67 Deg.		66¾ Deg.		66½ Deg.		66¼ Deg.		

Dist.	23 Deg. Lat.	23 Deg. Dep.	23¼ Deg. Lat.	23¼ Deg. Dep.	23½ Deg. Lat.	23½ Deg. Dep.	23¾ Deg. Lat.	23¾ Deg. Dep.	Dist.
51	46,95	19,93	46,86	20,13	46,77	20,34	46,68	20,54	51
52	47,87	20,32	47,78	20,53	47,69	20,73	47,60	20,94	52
53	48,79	20,71	48,70	20,92	48,60	21,13	48,51	21,35	53
54	49,71	21,10	49,61	21,32	49,52	21,53	49,43	21,75	54
55	50,63	21,49	50,53	21,71	50,44	21,93	50,34	22,15	55
56	51,55	21,88	51,45	22,11	51,36	22,33	51,26	22,55	56
57	52,47	22,27	52,37	22,50	52,27	22,73	52,17	22,96	57
58	53,39	22,66	53,29	22,90	53,19	23,13	53,09	23,36	58
59	54,31	23,05	54,21	23,29	54,11	23,53	54,00	23,76	59
60	55,23	23,44	55,13	23,68	55,02	23,92	54,92	24,16	60
61	56,15	23,83	56,05	24,08	55,94	24,32	55,83	24,57	61
62	57,07	24,23	56,97	24,47	56,86	24,72	56,75	24,97	62
63	57,99	24,62	57,88	24,87	57,77	25,12	57,66	25,37	63
64	58,91	25,01	58,80	25,26	58,69	25,52	58,58	25,78	64
65	59,83	25,40	59,72	25,66	59,61	25,92	59,50	26,18	65
66	60,75	25,79	60,64	26,05	60,53	26,32	60,41	26,58	66
67	61,67	26,18	61,56	26,45	61,44	26,72	61,33	26,98	67
68	62,59	26,57	62,48	26,84	62,36	27,11	62,24	27,39	68
69	63,51	26,96	63,40	27,24	63,28	27,51	63,16	27,79	69
70	64,44	27,35	64,32	27,63	64,19	27,91	64,07	28,19	70
71	65,36	27,74	65,23	28,03	65,11	28,31	64,99	28,59	71
72	66,28	28,13	66,15	28,42	66,03	28,71	65,90	29,00	72
73	67,20	28,52	67,07	28,82	66,95	29,11	66,82	29,40	73
74	68,12	28,91	67,99	29,21	67,86	29,51	67,73	29,80	74
75	69,04	29,30	68,91	29,61	68,78	29,91	68,65	30,21	75
76	69,96	29,70	69,83	30,00	69,70	30,30	69,56	30,61	76
77	70,88	30,09	70,75	30,40	70,61	30,70	70,48	31,01	77
78	71,80	30,48	71,67	30,79	71,53	31,10	71,39	31,41	78
79	72,72	30,87	72,58	31,18	72,45	31,50	72,31	31,82	79
80	73,64	31,26	73,50	31,58	73,36	31,90	73,22	32,22	80
81	74,56	31,65	74,42	31,97	74,28	32,30	74,14	32,62	81
82	75,48	32,04	75,34	32,37	75,20	32,70	75,06	33,03	82
83	76,40	32,43	76,26	32,76	76,12	33,10	75,97	33,43	83
84	77,32	32,82	77,18	33,16	77,03	33,49	76,89	33,83	84
85	78,24	33,21	78,10	33,55	77,95	33,89	77,80	34,23	85
86	79,16	33,60	79,02	33,95	78,87	34,29	78,72	34,64	86
87	80,08	33,99	79,93	34,34	79,78	34,69	79,63	35,04	87
88	81,00	34,38	80,85	34,74	80,70	35,09	80,55	35,44	88
89	81,92	34,78	81,77	35,13	81,62	35,49	81,46	35,84	89
90	82,85	35,17	82,69	35,53	82,54	35,89	82,38	36,25	90
91	83,77	35,56	83,61	35,92	83,45	36,29	83,29	36,65	91
92	84,69	35,95	84,53	36,32	84,37	36,68	84,21	37,05	92
93	85,61	36,34	85,45	36,71	85,29	37,08	85,12	37,46	93
94	86,53	36,73	86,37	37,11	86,20	37,48	86,04	37,86	94
95	87,45	37,12	87,29	37,50	87,12	37,88	86,95	38,26	95
96	88,37	37,51	88,20	37,90	88,04	38,28	87,87	38,66	96
97	89,29	37,90	89,12	38,29	88,95	38,68	88,79	39,07	97
98	90,21	38,29	90,04	38,68	89,87	39,08	89,70	39,47	98
99	91,13	38,68	90,96	39,08	90,79	39,48	90,62	39,87	99
100	92,05	39,07	91,88	39,47	91,71	39,87	91,53	40,27	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	67 Deg.		66¾ Deg.		66½ Deg.		66¼ Deg.		

Dist.	24 Deg. Lat.	24 Deg. Dep.	24¼ Deg. Lat.	24¼ Deg. Dep.	24½ Deg. Lat.	24½ Deg. Dep.	24¾ Deg. Lat.	24¾ Deg. Dep.	Dist.
1	0,91	0,41	0,91	0,41	0,91	0,41	0,91	0,42	1
2	1,83	0,81	1,82	0,82	1,82	0,83	1,82	0,84	2
3	2,74	1,22	2,74	1,23	2,73	1,24	2,72	1,26	3
4	3,65	1,63	3,65	1,64	3,64	1,66	3,63	1,67	4
5	4,57	2,03	4,56	2,05	4,55	2,07	4,54	2,09	5
6	5,48	2,44	5,47	2,46	5,46	2,49	5,45	2,51	6
7	6,39	2,85	6,38	2,87	6,37	2,90	6,36	2,93	7
8	7,31	3,25	7,29	3,29	7,28	3,32	7,27	3,35	8
9	8,22	3,66	8,21	3,70	8,19	3,73	8,17	3,77	9
10	9,14	4,07	9,12	4,11	9,10	4,15	9,08	4,19	10
11	10,05	4,47	10,03	4,52	10,01	4,56	9,99	4,61	11
12	10,96	4,88	10,94	4,93	10,92	4,98	10,90	5,02	12
13	11,88	5,29	11,85	5,34	11,83	5,39	11,81	5,44	13
14	12,79	5,69	12,76	5,75	12,74	5,81	12,71	5,86	14
15	13,70	6,10	13,68	6,16	13,65	6,22	13,62	6,28	15
16	14,62	6,51	14,59	6,57	14,56	6,64	14,53	6,70	16
17	15,53	6,92	15,50	6,98	15,47	7,05	15,44	7,12	17
18	16,44	7,32	16,41	7,39	16,38	7,46	16,35	7,54	18
19	17,36	7,73	17,32	7,80	17,29	7,88	17,25	7,95	19
20	18,27	8,13	18,24	8,21	18,20	8,29	18,16	8,37	20
21	19,18	8,54	19,15	8,63	19,11	8,71	19,07	8,79	21
22	20,10	8,95	20,06	9,04	20,02	9,12	19,98	9,21	22
23	21,01	9,35	20,97	9,45	20,93	9,54	20,89	9,63	23
24	21,93	9,76	21,88	9,86	21,84	9,95	21,80	10,05	24
25	22,84	10,17	22,79	10,27	22,75	10,37	22,70	10,47	25
26	23,75	10,58	23,71	10,68	23,66	10,78	23,61	10,89	26
27	24,67	10,98	24,62	11,09	24,57	11,20	24,52	11,30	27
28	25,58	11,39	25,53	11,50	25,48	11,61	25,43	11,72	28
29	26,49	11,80	26,44	11,91	26,39	12,03	26,34	12,14	29
30	27,41	12,20	27,35	12,32	27,30	12,44	27,24	12,56	30
31	28,32	12,61	28,26	12,73	28,21	12,86	28,15	12,98	31
32	29,23	13,02	29,18	13,14	29,12	13,27	29,06	13,40	32
33	30,15	13,42	30,09	13,55	30,03	13,68	29,97	13,82	33
34	31,06	13,83	31,00	13,96	30,94	14,10	30,88	14,23	34
35	31,97	14,24	31,91	14,38	31,85	14,51	31,78	14,65	35
36	32,89	14,64	32,82	14,79	32,76	14,93	32,69	15,07	36
37	33,80	15,05	33,74	15,20	33,67	15,34	33,60	15,49	37
38	34,71	15,46	34,65	15,61	34,58	15,76	34,51	15,91	38
39	35,63	15,86	35,56	16,02	35,49	16,17	35,42	16,33	39
40	36,54	16,27	36,47	16,43	36,40	16,59	36,33	16,75	40
41	37,46	16,68	37,38	16,84	37,31	17,00	37,23	17,16	41
42	38,37	17,08	38,29	17,25	38,22	17,40	38,14	17,58	42
43	39,28	17,49	39,21	17,66	39,13	17,83	39,05	18,00	43
44	40,20	17,90	40,12	18,07	40,04	18,25	39,96	18,42	44
45	41,11	18,30	41,03	18,48	40,95	18,66	40,87	18,84	45
46	42,02	18,71	41,94	18,89	41,86	19,08	41,77	19,26	46
47	42,94	19,12	42,85	19,30	42,77	19,49	42,68	19,68	47
48	43,85	19,52	43,76	19,71	43,68	19,91	43,59	20,10	48
49	44,76	19,93	44,68	20,13	44,59	20,32	44,50	20,51	49
50	45,68	20,34	45,59	20,54	45,50	20,73	45,41	20,93	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	66 Deg.		65¾ Deg.		65½ Deg.		65¼ Deg.		

Dist.	24 Deg. Lat.	24 Deg. Dep.	24¼ Deg. Lat.	24¼ Deg. Dep.	24½ Deg. Lat.	24½ Deg. Dep.	24¾ Deg. Lat.	24¾ Deg. Dep.	Dist.
51	46,59	20,74	46,50	20,95	46,41	21,15	46,32	21,35	51
52	47,50	21,15	47,41	21,36	47,32	21,56	47,22	21,77	52
53	48,42	21,56	48,32	21,77	48,23	21,98	48,13	22,19	53
54	49,33	21,96	49,24	22,18	49,14	22,39	49,04	22,61	54
55	50,24	22,37	50,15	22,59	50,05	22,81	49,95	23,03	55
56	51,16	22,78	51,06	23,00	50,96	23,22	50,86	23,44	56
57	52,07	23,18	51,97	23,41	51,87	23,64	51,76	23,86	57
58	52,99	23,59	52,88	23,82	52,78	24,05	52,67	24,28	58
59	53,90	24,00	53,79	24,23	53,69	24,47	53,58	24,70	59
60	54,81	24,40	54,71	24,64	54,60	24,88	54,49	25,12	60
61	55,73	24,81	55,62	25,05	55,51	25,30	55,40	25,54	61
62	56,64	25,22	56,53	25,46	56,42	25,71	56,30	25,96	62
63	57,55	25,62	57,44	25,88	57,33	26,13	57,21	26,38	63
64	58,47	26,03	58,35	26,29	58,24	26,54	58,12	26,79	64
65	59,38	26,44	59,26	26,70	59,15	26,96	59,03	27,21	65
66	60,29	26,84	60,18	27,11	60,06	27,37	59,94	27,63	66
67	61,21	27,25	61,09	27,52	60,97	27,78	60,85	28,05	67
68	62,12	27,66	62,00	27,93	61,88	28,20	61,75	28,47	68
69	63,03	28,06	62,91	28,34	62,79	28,61	62,66	28,89	69
70	63,95	28,47	63,82	28,75	63,70	29,03	63,57	29,31	70
71	64,86	28,88	64,74	29,16	64,61	29,44	64,48	29,72	71
72	65,78	29,28	65,65	29,57	65,52	29,86	65,39	30,14	72
73	66,69	29,69	66,56	29,98	66,43	30,27	66,29	30,56	73
74	67,60	30,10	67,47	30,39	67,34	30,69	67,20	30,98	74
75	68,52	30,51	68,38	30,80	68,25	31,10	68,11	31,40	75
76	69,43	30,91	69,29	31,21	69,16	31,52	69,02	31,82	76
77	70,34	31,32	70,21	31,63	70,07	31,93	69,93	32,24	77
78	71,26	31,73	71,12	32,04	70,98	32,35	70,84	32,66	78
79	72,17	32,13	72,03	32,45	71,89	32,76	71,74	33,07	79
80	73,08	32,54	72,94	32,86	72,80	33,18	72,65	33,49	80
81	74,00	32,95	73,85	33,27	73,71	33,59	73,56	33,91	81
82	74,91	33,35	74,76	33,68	74,62	34,00	74,47	34,33	82
83	75,82	33,76	75,68	34,09	75,53	34,42	75,38	34,75	83
84	76,74	34,17	76,59	34,50	76,44	34,83	76,28	35,17	84
85	77,65	34,57	77,50	34,91	77,35	35,25	77,19	35,59	85
86	78,56	34,98	78,41	35,32	78,26	35,66	78,10	36,00	86
87	79,48	35,39	79,32	35,73	79,17	36,08	79,01	36,42	87
88	80,39	35,79	80,24	36,14	80,08	36,49	79,92	36,84	88
89	81,31	36,20	81,15	36,55	80,99	36,91	80,82	37,26	89
90	82,22	36,61	82,06	36,96	81,90	37,32	81,73	37,68	90
91	83,13	37,01	82,97	37,38	82,81	37,74	82,64	38,10	91
92	84,05	37,42	83,88	37,79	83,72	38,15	83,55	38,52	92
93	84,96	37,83	84,79	38,20	84,63	38,57	84,46	38,94	93
94	85,87	38,23	85,71	38,61	85,54	38,98	85,37	39,35	94
95	86,79	38,64	86,62	39,02	86,45	39,40	86,27	39,77	95
96	87,70	39,05	87,53	39,43	87,36	39,81	87,18	40,19	96
97	88,61	39,45	88,44	39,84	88,27	40,23	88,09	40,61	97
98	89,53	39,86	89,35	40,25	89,18	40,64	89,00	41,03	98
99	90,44	40,27	90,26	40,66	90,09	41,05	89,91	41,45	99
100	91,35	40,67	91,18	41,07	91,00	41,47	90,81	41,87	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	66 Deg.		65¾ Deg.		65½ Deg.		65¼ Deg.		

Dist.	25 Deg.		25¼ Deg.		25½ Deg.		25¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,91	0,42	0,90	0,43	0,90	0,43	0,90	0,43	1
2	1,81	0,85	1,81	0,85	1,81	0,86	1,80	0,87	2
3	2,72	1,27	2,71	1,28	2,71	1,29	2,70	1,30	3
4	3,63	1,69	3,62	1,71	3,61	1,72	3,60	1,74	4
5	4,53	2,11	4,52	2,13	4,51	2,15	4,50	2,17	5
6	5,44	2,54	5,43	2,56	5,42	2,58	5,40	2,61	6
7	6,34	2,96	6,33	2,99	6,32	3,01	6,30	3,04	7
8	7,25	3,38	7,24	3,41	7,22	3,44	7,21	3,48	8
9	8,16	3,80	8,14	3,84	8,12	3,87	8,11	3,91	9
10	9,06	4,23	9,04	4,27	9,03	4,31	9,01	4,34	10
11	9,97	4,65	9,95	4,69	9,93	4,74	9,91	4,78	11
12	10,88	5,07	10,85	5,12	10,83	5,17	10,81	5,21	12
13	11,78	5,49	11,76	5,55	11,73	5,60	11,71	5,65	13
14	12,69	5,92	12,66	5,97	12,64	6,03	12,61	6,08	14
15	13,59	6,34	13,57	6,40	13,54	6,46	13,51	6,52	15
16	14,50	6,76	14,47	6,83	14,44	6,89	14,41	6,95	16
17	15,41	7,18	15,38	7,25	15,34	7,32	15,31	7,39	17
18	16,31	7,61	16,28	7,68	16,25	7,75	16,21	7,82	18
19	17,22	8,03	17,18	8,10	17,15	8,18	17,11	8,25	19
20	18,13	8,45	18,09	8,53	18,05	8,61	18,01	8,69	20
21	19,03	8,87	18,99	8,96	18,95	9,04	18,91	9,12	21
22	19,94	9,30	19,90	9,38	19,86	9,47	19,82	9,56	22
23	20,85	9,72	20,80	9,81	20,76	9,90	20,72	9,99	23
24	21,75	10,14	21,71	10,24	21,66	10,33	21,62	10,43	24
25	22,66	10,57	22,61	10,66	22,56	10,76	22,52	10,86	25
26	23,56	10,99	23,52	11,09	23,47	11,19	23,42	11,30	26
27	24,47	11,41	24,42	11,52	24,37	11,62	24,32	11,73	27
28	25,38	11,83	25,32	11,94	25,27	12,05	25,22	12,16	28
29	26,28	12,26	26,23	12,37	26,17	12,48	26,12	12,60	29
30	27,19	12,68	27,13	12,80	27,08	12,92	27,02	13,03	30
31	28,10	13,10	28,04	13,22	27,98	13,35	27,92	13,47	31
32	29,00	13,52	28,94	13,65	28,88	13,78	28,82	13,90	32
33	29,91	13,95	29,85	14,08	29,79	14,21	29,72	14,34	33
34	30,81	14,37	30,75	14,50	30,69	14,64	30,62	14,77	34
35	31,72	14,79	31,66	14,93	31,59	15,07	31,52	15,21	35
36	32,63	15,21	32,56	15,36	32,49	15,50	32,43	15,64	36
37	33,53	15,64	33,46	15,78	33,40	15,93	33,33	16,07	37
38	34,44	16,06	34,37	16,21	34,30	16,36	34,23	16,51	38
39	35,35	16,48	35,27	16,64	35,20	16,79	35,13	16,94	39
40	36,25	16,90	36,18	17,06	36,10	17,22	36,03	17,38	40
41	37,16	17,33	37,08	17,49	37,01	17,65	36,93	17,81	41
42	38,06	17,75	37,99	17,92	37,91	18,08	37,83	18,25	42
43	38,97	18,17	38,89	18,34	38,81	18,51	38,73	18,68	43
44	39,88	18,60	39,80	18,77	39,71	18,94	39,63	19,12	44
45	40,78	19,02	40,70	19,20	40,62	19,37	40,53	19,55	45
46	41,69	19,44	41,60	19,62	41,52	19,80	41,43	19,98	46
47	42,60	19,86	42,51	20,05	42,42	20,23	42,33	20,42	47
48	43,50	20,29	43,41	20,48	43,32	20,66	43,23	20,85	48
49	44,41	20,71	44,32	20,90	44,23	21,10	44,13	21,29	49
50	45,32	21,13	45,22	21,33	45,13	21,53	45,03	21,72	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	65 Deg.		64¾ Deg.		64½ Deg.		64¼ Deg.		

Dist.	25 Deg. Lat.	25 Deg. Dep.	$25\frac{1}{4}$ Deg. Lat.	$25\frac{1}{4}$ Deg. Dep.	$25\frac{1}{2}$ Deg. Lat.	$25\frac{1}{2}$ Deg. Dep.	$25\frac{3}{4}$ Deg. Lat.	$25\frac{3}{4}$ Deg. Dep.	Dist.
51	46,22	21,55	46,13	21,75	46,03	21,96	45,94	22,16	51
52	47,13	21,98	47,03	22,18	46,93	22,39	46,84	22,59	52
53	48,03	22,40	47,94	22,61	47,84	22,82	47,74	23,03	53
54	48,94	22,82	48,84	23,03	48,74	23,25	48,64	23,46	54
55	49,85	23,24	49,74	23,46	49,64	23,68	49,54	23,89	55
56	50,75	23,67	50,65	23,89	50,54	24,11	50,44	24,33	56
57	51,66	24,09	51,55	24,31	51,45	24,54	51,34	24,76	57
58	52,57	24,51	52,46	24,74	52,35	24,97	52,24	25,20	58
59	53,47	24,93	53,36	25,17	53,25	25,40	53,14	25,63	59
60	54,38	25,36	54,27	25,59	54,16	25,83	54,04	26,07	60
61	55,28	25,78	55,17	26,02	55,06	26,26	54,94	26,50	61
62	56,19	26,20	56,08	26,45	55,96	26,69	55,84	26,94	62
63	57,10	26,62	56,98	26,87	56,86	27,12	56,74	27,37	63
64	58,00	27,05	57,89	27,30	57,77	27,55	57,64	27,80	64
65	58,91	27,47	58,79	27,73	58,67	27,98	58,55	28,24	65
66	59,82	27,89	59,69	28,15	59,57	28,41	59,45	28,67	66
67	60,72	28,32	60,60	28,58	60,47	28,84	60,35	29,11	67
68	61,63	28,74	61,50	29,01	61,38	29,27	61,25	29,54	68
69	62,54	29,16	62,41	29,43	62,28	29,71	62,15	29,98	69
70	63,44	29,58	63,31	29,86	63,18	30,14	63,05	30,41	70
71	64,35	30,01	64,22	30,29	64,08	30,57	63,95	30,85	71
72	65,25	30,43	65,12	30,71	64,99	31,00	64,85	31,28	72
73	66,16	30,85	66,03	31,14	65,89	31,43	65,75	31,71	73
74	67,07	31,27	66,93	31,57	66,79	31,86	66,65	32,15	74
75	67,97	31,70	67,83	31,99	67,69	32,29	67,55	32,58	75
76	68,88	32,12	68,74	32,42	68,60	32,72	68,45	33,02	76
77	69,79	32,54	69,64	32,85	69,50	33,15	69,35	33,45	77
78	70,69	32,96	70,55	33,27	70,40	33,58	70,25	33,89	78
79	71,60	33,39	71,45	33,70	71,30	34,01	71,16	34,32	79
80	72,50	33,81	72,36	34,13	72,21	34,44	72,06	34,76	80
81	73,41	34,23	73,26	34,55	73,11	34,87	72,96	35,19	81
82	74,32	34,65	74,17	34,98	74,01	35,30	73,86	35,62	82
83	75,22	35,08	75,07	35,41	74,91	35,73	74,76	36,06	83
84	76,13	35,50	75,97	35,83	75,82	36,16	75,66	36,49	84
85	77,04	35,92	76,88	36,26	76,72	36,59	76,56	36,93	85
86	77,94	36,35	77,78	36,68	77,62	37,02	77,46	37,36	86
87	78,85	36,77	78,69	37,11	78,52	37,45	78,36	37,80	87
88	79,76	37,19	79,59	37,54	79,43	37,88	79,26	38,23	88
89	80,66	37,61	80,50	37,96	80,33	38,32	80,16	38,67	89
90	81,57	38,04	81,40	38,39	81,23	38,75	81,06	39,10	90
91	82,47	38,46	82,31	38,82	82,14	39,18	81,96	39,53	91
92	83,38	38,88	83,21	39,24	83,04	39,61	82,86	39,97	92
93	84,29	39,30	84,11	39,67	83,94	40,04	83,76	40,40	93
94	85,19	39,73	85,02	40,10	84,84	40,47	84,67	40,84	94
95	86,10	40,15	85,92	40,52	85,75	40,90	85,57	41,27	95
96	87,01	40,57	86,83	40,95	86,65	41,33	86,47	41,71	96
97	87,91	40,99	87,73	41,38	87,55	41,76	87,37	42,14	97
98	88,82	41,42	88,64	41,80	88,45	42,19	88,27	42,58	98
99	89,72	41,84	89,54	42,23	89,36	42,62	89,17	43,01	99
100	90,63	42,26	90,45	42,66	90,26	43,05	90,07	43,44	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	65 Deg.		$64\frac{3}{4}$ Deg.		$64\frac{1}{2}$ Deg.		$64\frac{1}{4}$ Deg.		

Dist.	26 Deg.		26¼ Deg.		26½ Deg.		26¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,90	0,44	0,90	0,44	0,89	0,45	0,89	0,45	1
2	1,80	0,88	1,79	0,88	1,79	0,89	1,79	0,90	2
3	2,70	1,32	2,69	1,33	2,68	1,34	2,68	1,35	3
4	3,60	1,75	3,59	1,77	3,58	1,78	3,57	1,80	4
5	4,49	2,19	4,48	2,21	4,47	2,23	4,46	2,25	5
6	5,39	2,63	5,38	2,65	5,37	2,68	5,36	2,70	6
7	6,29	3,07	6,28	3,10	6,26	3,12	6,25	3,15	7
8	7,19	3,51	7,17	3,54	7,16	3,57	7,14	3,60	8
9	8,09	3,95	8,07	3,98	8,05	4,02	8,04	4,05	9
10	8,99	4,38	8,97	4,42	8,95	4,46	8,93	4,50	10
11	9,89	4,82	9,87	4,87	9,84	4,91	9,82	4,95	11
12	10,79	5,26	10,76	5,31	10,74	5,35	10,72	5,40	12
13	11,68	5,70	11,66	5,75	11,63	5,80	11,61	5,85	13
14	12,58	6,14	12,56	6,19	12,53	6,25	12,50	6,30	14
15	13,48	6,58	13,45	6,63	13,42	6,69	13,39	6,75	15
16	14,38	7,01	14,35	7,08	14,32	7,14	14,29	7,20	16
17	15,28	7,45	15,25	7,52	15,21	7,59	15,18	7,65	17
18	16,18	7,89	16,14	7,96	16,11	8,03	16,07	8,10	18
19	17,08	8,33	17,04	8,40	17,00	8,48	16,97	8,55	19
20	17,98	8,77	17,94	8,85	17,90	8,92	17,86	9,00	20
21	18,87	9,21	18,83	9,29	18,79	9,37	18,75	9,45	21
22	19,77	9,64	19,73	9,73	19,69	9,82	19,65	9,90	22
23	20,67	10,08	20,63	10,17	20,58	10,26	20,54	10,35	23
24	21,57	10,52	21,52	10,61	21,48	10,71	21,43	10,80	24
25	22,47	10,96	22,42	11,06	22,37	11,15	22,32	11,25	25
26	23,37	11,40	23,32	11,50	23,27	11,60	23,22	11,70	26
27	24,27	11,84	24,22	11,94	24,16	12,05	24,11	12,15	27
28	25,17	12,27	25,11	12,38	25,06	12,49	25,00	12,60	28
29	26,06	12,71	26,01	12,83	25,95	12,94	25,90	13,05	29
30	26,96	13,15	26,91	13,27	26,85	13,39	26,79	13,50	30
31	27,86	13,59	27,80	13,71	27,74	13,83	27,68	13,95	31
32	28,76	14,03	28,70	14,15	28,64	14,28	28,58	14,40	32
33	29,66	14,47	29,60	14,60	29,53	14,72	29,47	14,85	33
34	30,56	14,90	30,49	15,04	30,43	15,17	30,36	15,30	34
35	31,46	15,34	31,39	15,48	31,32	15,62	31,25	15,75	35
36	32,36	15,78	32,29	15,92	32,22	16,06	32,15	16,20	36
37	33,26	16,22	33,18	16,36	33,11	16,51	33,04	16,65	37
38	34,15	16,66	34,08	16,81	34,01	16,96	33,93	17,10	38
39	35,05	17,10	34,98	17,25	34,90	17,40	34,83	17,55	39
40	35,95	17,53	35,87	17,69	35,80	17,85	35,72	18,00	40
41	36,85	17,97	36,77	18,13	36,69	18,29	36,61	18,45	41
42	37,75	18,41	37,67	18,58	37,59	18,74	37,51	18,90	42
43	38,65	18,85	38,57	19,02	38,48	19,19	38,40	19,35	43
44	39,55	19,29	39,46	19,46	39,38	19,63	39,29	19,80	44
45	40,45	19,73	40,36	19,90	40,27	20,08	40,18	20,25	45
46	41,34	20,17	41,26	20,35	41,17	20,53	41,08	20,70	46
47	42,24	20,60	42,15	20,79	42,06	20,97	41,97	21,15	47
48	43,14	21,04	43,05	21,23	42,96	21,42	42,86	21,60	48
49	44,04	21,48	43,95	21,67	43,85	21,86	43,76	22,05	49
50	44,94	21,92	44,84	22,11	44,75	22,31	44,65	22,50	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	64 Deg.		63¾ Deg.		63½ Deg.		63¼ Deg.		

Dist.	26 Deg.		26¼ Deg.		26½ Deg.		26¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	45,84	22,36	45,74	22,56	45,64	22,76	45,54	22,95	51
52	46,74	22,80	46,64	23,00	46,54	23,20	46,43	23,41	52
53	47,64	23,23	47,53	23,44	47,43	23,65	47,33	23,86	53
54	48,53	23,67	48,43	23,88	48,33	24,09	48,22	24,31	54
55	49,43	24,11	49,33	24,33	49,22	24,54	49,11	24,76	55
56	50,33	24,55	50,22	24,77	50,12	24,99	50,01	25,21	56
57	51,23	24,99	51,12	25,21	51,01	25,43	50,90	25,66	57
58	52,13	25,43	52,02	25,65	51,91	25,88	51,79	26,11	58
59	53,03	25,86	52,92	26,09	52,80	26,33	52,69	26,56	59
60	53,93	26,30	53,81	26,54	53,70	26,77	53,58	27,01	60
61	54,83	26,74	54,71	26,98	54,59	27,22	54,47	27,46	61
62	55,73	27,18	55,61	27,42	55,49	27,66	55,36	27,91	62
63	56,62	27,62	56,50	27,86	56,38	28,11	56,26	28,36	63
64	57,52	28,06	57,40	28,31	57,28	28,56	57,15	28,81	64
65	58,42	28,49	58,30	28,75	58,17	29,00	58,04	29,26	65
66	59,32	28,93	59,19	29,19	59,07	29,45	58,94	29,71	66
67	60,22	29,37	60,09	29,63	59,96	29,90	59,83	30,16	67
68	61,12	29,81	60,99	30,08	60,86	30,34	60,72	30,61	68
69	62,02	30,25	61,88	30,52	61,75	30,79	61,62	31,06	69
70	62,92	30,69	62,78	30,96	62,65	31,23	62,51	31,51	70
71	63,81	31,12	63,68	31,40	63,54	31,68	63,40	31,96	71
72	64,71	31,56	64,57	31,84	64,44	32,13	64,29	32,41	72
73	65,61	32,00	65,47	32,29	65,33	32,57	65,19	32,86	73
74	66,51	32,44	66,37	32,73	66,23	33,02	66,08	33,31	74
75	67,41	32,88	67,27	33,17	67,12	33,46	66,97	33,76	75
76	68,31	33,32	68,16	33,61	68,01	33,91	67,87	34,21	76
77	69,21	33,75	69,06	34,06	68,91	34,36	68,76	34,66	77
78	70,11	34,19	69,96	34,50	69,80	34,80	69,65	35,11	78
79	71,00	34,63	70,85	34,94	70,70	35,25	70,55	35,56	79
80	71,90	35,07	71,75	35,38	71,59	35,70	71,44	36,01	80
81	72,80	35,51	72,65	35,83	72,49	36,14	72,33	36,46	81
82	73,70	35,95	73,54	36,27	73,38	36,59	73,22	36,91	82
83	74,60	36,38	74,44	36,71	74,28	37,03	74,12	37,36	83
84	75,50	36,82	75,34	37,15	75,17	37,48	75,01	37,81	84
85	76,40	37,26	76,23	37,59	76,07	37,93	75,90	38,26	85
86	77,30	37,70	77,13	38,04	76,96	38,37	76,80	38,71	86
87	78,20	38,14	78,03	38,48	77,86	38,82	77,69	39,16	87
88	79,09	38,58	78,92	38,92	78,75	39,27	78,58	39,61	88
89	79,99	39,01	79,82	39,36	79,65	39,71	79,48	40,06	89
90	80,89	39,45	80,72	39,81	80,54	40,16	80,37	40,51	90
91	81,79	39,89	81,62	40,25	81,44	40,60	81,26	40,96	91
92	82,69	40,33	82,51	40,69	82,33	41,05	82,15	41,41	92
93	83,59	40,77	83,41	41,13	83,23	41,50	83,05	41,86	93
94	84,49	41,21	84,31	41,58	84,12	41,94	83,94	42,31	94
95	85,39	41,65	85,20	42,02	85,02	42,39	84,83	42,76	95
96	86,28	42,08	86,10	42,46	85,91	42,83	85,73	43,21	96
97	87,18	42,52	87,00	42,90	86,81	43,28	86,62	43,66	97
98	88,08	42,96	87,89	43,34	87,70	43,73	87,51	44,11	98
99	88,98	43,40	88,79	43,79	88,60	44,17	88,40	44,56	99
100	89,88	43,84	89,69	44,23	89,49	44,62	89,30	45,01	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	64 Deg.		63¾ Deg.		63½ Deg.		63¼ Deg.		

Dist.	27 Deg.		27¼ Deg.		27½ Deg.		27¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,89	0,45	0,89	0,46	0,89	0,46	0,88	0,47	1
2	1,78	0,91	1,78	0,92	1,77	0,92	1,77	0,93	2
3	2,67	1,36	2,67	1,37	2,66	1,39	2,65	1,40	3
4	3,56	1,82	3,56	1,83	3,55	1,85	3,54	1,86	4
5	4,45	2,27	4,45	2,29	4,44	2,31	4,42	2,33	5
6	5,35	2,72	5,33	2,75	5,32	2,77	5,31	2,79	6
7	6,24	3,18	6,22	3,21	6,21	3,23	6,19	3,26	7
8	7,13	3,63	7,11	3,66	7,10	3,69	7,08	3,72	8
9	8,02	4,09	8,00	4,12	7,98	4,16	7,96	4,19	9
10	8,91	4,54	8,89	4,58	8,87	4,62	8,85	4,66	10
11	9,80	4,99	9,78	5,04	9,76	5,08	9,73	5,12	11
12	10,69	5,45	10,67	5,49	10,64	5,54	10,62	5,59	12
13	11,58	5,90	11,56	5,95	11,53	6,00	11,50	6,05	13
14	12,47	6,36	12,45	6,41	12,42	6,46	12,39	6,52	14
15	13,37	6,81	13,34	6,87	13,31	6,93	13,27	6,98	15
16	14,26	7,26	14,22	7,33	14,19	7,39	14,16	7,45	16
17	15,15	7,72	15,11	7,78	15,08	7,85	15,04	7,92	17
18	16,04	8,17	16,00	8,24	15,97	8,31	15,93	8,38	18
19	16,93	8,63	16,89	8,70	16,85	8,77	16,81	8,85	19
20	17,82	9,08	17,78	9,16	17,74	9,23	17,70	9,31	20
21	18,71	9,53	18,67	9,62	18,63	9,70	18,58	9,78	21
22	19,60	9,99	19,56	10,07	19,51	10,16	19,47	10,24	22
23	20,49	10,44	20,45	10,53	20,40	10,62	20,35	10,71	23
24	21,38	10,90	21,34	10,99	21,29	11,08	21,24	11,17	24
25	22,28	11,35	22,23	11,45	22,18	11,54	22,12	11,64	25
26	23,17	11,80	23,11	11,90	23,06	12,01	23,01	12,11	26
27	24,06	12,26	24,00	12,36	23,95	12,47	23,89	12,57	27
28	24,95	12,71	24,89	12,82	24,84	12,93	24,78	13,04	28
29	25,84	13,17	25,78	13,28	25,72	13,39	25,66	13,50	29
30	26,73	13,62	26,67	13,74	26,61	13,85	26,55	13,97	30
31	27,62	14,07	27,56	14,19	27,50	14,31	27,43	14,43	31
32	28,51	14,53	28,45	14,65	28,38	14,78	28,32	14,90	32
33	29,40	14,98	29,34	15,11	29,27	15,24	29,20	15,37	33
34	30,29	15,44	30,23	15,57	30,16	15,70	30,09	15,83	34
35	31,19	15,89	31,12	16,03	31,05	16,16	30,97	16,30	35
36	32,08	16,34	32,00	16,48	31,93	16,62	31,86	16,76	36
37	32,97	16,80	32,89	16,94	32,82	17,08	32,74	17,23	37
38	33,86	17,25	33,78	17,40	33,71	17,55	33,63	17,69	38
39	34,75	17,71	34,67	17,86	34,59	18,01	34,51	18,16	39
40	35,64	18,16	35,56	18,31	35,48	18,47	35,40	18,62	40
41	36,53	18,61	36,45	18,77	36,37	18,93	36,28	19,09	41
42	37,42	19,07	37,34	19,23	37,25	19,39	37,17	19,56	42
43	38,31	19,52	38,23	19,69	38,14	19,86	38,05	20,02	43
44	39,20	19,98	39,12	20,15	39,03	20,32	38,94	20,49	44
45	40,10	20,43	40,01	20,60	39,92	20,78	39,82	20,95	45
46	40,99	20,88	40,89	21,06	40,80	21,24	40,71	21,42	46
47	41,88	21,34	41,78	21,52	41,69	21,70	41,59	21,88	47
48	42,77	21,79	42,67	21,98	42,58	22,16	42,48	22,35	48
49	43,66	22,25	43,56	22,44	43,46	22,63	43,36	22,82	49
50	44,55	22,70	44,45	22,89	44,35	23,09	44,25	23,28	50
Dist.	Dep	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	63 Deg.		62¾ Deg.		62½ Deg.		62¼ Deg.		

Dist.	27 Deg. Lat.	27 Deg. Dep.	27¼ Deg. Lat.	27¼ Deg. Dep.	27½ Deg. Lat.	27½ Deg. Dep.	27¾ Deg. Lat.	27¾ Deg. Dep.	Dist.
51	45,44	23,15	45,34	23,35	45,24	23,55	45,13	23,75	51
52	46,33	23,61	46,23	23,81	46,12	24,01	46,02	24,21	52
53	47,22	24,06	47,12	24,27	47,01	24,47	46,90	24,68	53
54	48,11	24,52	48,01	24,73	47,90	24,93	47,79	25,14	54
55	49,01	24,97	48,90	25,18	48,79	25,40	48,67	25,61	55
56	49,90	25,42	49,78	25,64	49,67	25,86	49,56	26,07	56
57	50,79	25,88	50,67	26,10	50,56	26,32	50,44	26,54	57
58	51,68	26,33	51,56	26,56	51,45	26,78	51,33	27,01	58
59	52,57	26,79	52,45	27,01	52,33	27,24	52,21	27,47	59
60	53,46	27,24	53,34	27,47	53,22	27,70	53,10	27,94	60
61	54,35	27,69	54,23	27,93	54,11	28,17	53,98	28,40	61
62	55,24	28,15	55,12	28,39	54,99	28,63	54,87	28,87	62
63	56,13	28,60	56,01	28,85	55,88	29,09	55,75	29,33	63
64	57,02	29,06	56,90	29,30	56,77	29,55	56,64	29,80	64
65	57,92	29,51	57,79	29,76	57,66	30,01	57,52	30,26	65
66	58,81	29,96	58,68	30,22	58,54	30,48	58,41	30,73	66
67	59,70	30,42	59,56	30,68	59,43	30,94	59,29	31,20	67
68	60,59	30,87	60,45	31,14	60,32	31,40	60,18	31,66	68
69	61,48	31,33	61,34	31,59	61,20	31,86	61,06	32,13	69
70	62,37	31,78	62,23	32,05	62,09	32,32	61,95	32,59	70
71	63,26	32,23	63,12	32,51	62,98	32,78	62,83	33,06	71
72	64,15	32,69	64,01	32,97	63,86	33,25	63,72	33,52	72
73	65,04	33,14	64,90	33,42	64,75	33,71	64,60	33,99	73
74	65,93	33,60	65,79	33,88	65,64	34,17	65,49	34,46	74
75	66,83	34,05	66,68	34,34	66,53	34,63	66,37	34,92	75
76	67,72	34,50	67,57	34,80	67,41	35,09	67,26	35,39	76
77	68,61	34,96	68,45	35,26	68,30	35,55	68,14	35,85	77
78	69,50	35,41	69,34	35,71	69,19	36,02	69,03	36,32	78
79	70,39	35,87	70,23	36,17	70,07	36,48	69,91	36,78	79
80	71,28	36,32	71,12	36,63	70,96	36,94	70,80	37,25	80
81	72,17	36,77	72,01	37,09	71,85	37,40	71,68	37,71	81
82	73,06	37,23	72,90	37,55	72,73	37,86	72,57	38,18	82
83	73,95	37,68	73,79	38,00	73,62	38,33	73,45	38,65	83
84	74,84	38,14	74,68	38,46	74,51	38,79	74,34	39,11	84
85	75,74	38,59	75,57	38,92	75,40	39,25	75,22	39,58	85
86	76,63	39,04	76,46	39,38	76,28	39,71	76,11	40,04	86
87	77,52	39,50	77,34	39,83	77,17	40,17	76,99	40,51	87
88	78,41	39,95	78,23	40,29	78,06	40,63	77,88	40,97	88
89	79,30	40,41	79,12	40,75	78,94	41,10	78,76	41,44	89
90	80,19	40,86	80,01	41,21	79,83	41,56	79,65	41,91	90
91	81,08	41,31	80,90	41,67	80,72	42,02	80,53	42,37	91
92	81,97	41,77	81,79	42,12	81,60	42,48	81,42	42,84	92
93	82,86	42,22	82,68	42,58	82,49	42,94	82,30	43,30	93
94	83,75	42,68	83,57	43,04	83,38	43,40	83,19	43,77	94
95	84,65	43,13	84,46	43,50	84,27	43,87	84,07	44,23	95
96	85,54	43,58	85,35	43,96	85,15	44,33	84,96	44,70	96
97	86,43	44,04	86,23	44,41	86,04	44,79	85,84	45,16	97
98	87,32	44,49	87,12	44,87	86,93	45,25	86,73	45,63	98
99	88,21	44,95	88,01	45,33	87,81	45,71	87,61	46,10	99
100	89,10	45,40	88,90	45,79	88,70	46,17	88,50	46,56	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep	Lat.	Dist.
	63 Deg.		62¾ Deg.		62½ Deg.		62¼ Deg.		

Dist.	28 Deg. Lat.	28 Deg. Dep.	28¼ Deg. Lat.	28¼ Deg. Dep.	28½ Deg. Lat.	28½ Deg. Dep.	28¾ Deg. Lat.	28¾ Deg. Dep.	Dist.
1	0,88	0,47	0,88	0,47	0,88	0,48	0,88	0,48	1
2	1,77	0,94	1,76	0,95	1,76	0,95	1,75	0,96	2
3	2,65	1,41	2,64	1,42	2,64	1,43	2,63	1,44	3
4	3,53	1,88	3,52	1,89	3,52	1,91	3,51	1,92	4
5	4,41	2,35	4,40	2,37	4,39	2,39	4,38	2,40	5
6	5,30	2,82	5,29	2,84	5,27	2,86	5,26	2,89	6
7	6,18	3,29	6,17	3,31	6,15	3,34	6,14	3,37	7
8	7,06	3,76	7,05	3,79	7,03	3,82	7,01	3,85	8
9	7,95	4,23	7,93	4,26	7,91	4,29	7,89	4,33	9
10	8,83	4,69	8,81	4,73	8,79	4,77	8,77	4,81	10
11	9,71	5,16	9,69	5,21	9,67	5,25	9,64	5,29	11
12	10,60	5,63	10,57	5,68	10,55	5,73	10,52	5,77	12
13	11,48	6,10	11,45	6,15	11,42	6,20	11,40	6,25	13
14	12,36	6,57	12,33	6,63	12,30	6,68	12,27	6,73	14
15	13,24	7,04	13,21	7,10	13,18	7,16	13,15	7,21	15
16	14,13	7,51	14,09	7,57	14,06	7,63	14,03	7,70	16
17	15,01	7,98	14,98	8,05	14,94	8,11	14,90	8,18	17
18	15,89	8,45	15,86	8,52	15,82	8,59	15,78	8,66	18
19	16,78	8,92	16,74	8,99	16,70	9,07	16,66	9,14	19
20	17,66	9,39	17,62	9,47	17,58	9,54	17,53	9,62	20
21	18,54	9,86	18,50	9,94	18,46	10,02	18,41	10,10	21
22	19,42	10,33	19,38	10,41	19,33	10,50	19,29	10,58	22
23	20,31	10,80	20,26	10,89	20,21	10,97	20,16	11,06	23
24	21,19	11,27	21,14	11,36	21,09	11,45	21,04	11,54	24
25	22,07	11,74	22,02	11,83	21,97	11,93	21,92	12,02	25
26	22,96	12,21	22,90	12,31	22,85	12,41	22,79	12,51	26
27	23,84	12,68	23,78	12,78	23,73	12,88	23,67	12,99	27
28	24,72	13,15	24,66	13,25	24,61	13,36	24,55	13,47	28
29	25,61	13,61	25,55	13,73	25,49	13,84	25,43	13,95	29
30	26,49	14,08	26,43	14,20	26,36	14,31	26,30	14,43	30
31	27,37	14,55	27,31	14,67	27,24	14,79	27,18	14,91	31
32	28,25	15,02	28,19	15,15	28,12	15,27	28,06	15,39	32
33	29,14	15,49	29,07	15,62	29,00	15,75	28,93	15,87	33
34	30,02	15,96	29,95	16,09	29,88	16,22	29,81	16,35	34
35	30,90	16,43	30,83	16,57	30,76	16,70	30,69	16,83	35
36	31,79	16,90	31,71	17,04	31,64	17,18	31,56	17,32	36
37	32,67	17,37	32,59	17,51	32,52	17,65	32,44	17,80	37
38	33,55	17,84	33,47	17,99	33,39	18,13	33,32	18,28	38
39	34,43	18,31	34,35	18,46	34,27	18,61	34,19	18,76	39
40	35,32	18,78	35,24	18,93	35,15	19,09	35,07	19,24	40
41	36,20	19,25	36,12	19,41	36,03	19,56	35,95	19,72	41
42	37,08	19,72	37,00	19,88	36,91	20,04	36,82	20,20	42
43	37,97	20,19	37,88	20,35	37,79	20,52	37,70	20,68	43
44	38,85	20,66	38,76	20,83	38,67	20,99	38,58	21,16	44
45	39,73	21,13	39,64	21,30	39,55	21,47	39,45	21,64	45
46	40,62	21,60	40,52	21,77	40,43	21,95	40,33	22,13	46
47	41,50	22,07	41,40	22,25	41,30	22,43	41,21	22,61	47
48	42,38	22,53	42,28	22,72	42,18	22,90	42,08	23,09	48
49	43,26	23,00	43,16	23,19	43,06	23,38	42,96	23,57	49
50	44,15	23,47	44,04	23,67	43,94	23,86	43,84	24,05	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	62 Deg.		61¾ Deg.		61½ Deg.		61¼ Deg.		

Dist.	28 Deg. Lat.	28 Deg. Dep.	28¼ Deg. Lat.	28¼ Deg. Dep.	28½ Deg. Lat.	28½ Deg. Dep.	28¾ Deg. Lat.	28¾ Deg. Dep.	Dist.
51	45,03	23,94	44,93	24,14	44,82	24,34	44,71	24,53	51
52	45,91	24,41	45,81	24,61	45,70	24,81	45,59	25,01	52
53	46,80	24,88	46,69	25,09	46,58	25,29	46,47	25,49	53
54	47,68	25,35	47,57	25,56	47,46	25,77	47,34	25,97	54
55	48,56	25,82	48,45	26,03	48,33	26,24	48,22	26,45	55
56	49,45	26,29	49,33	26,51	49,21	26,72	49,10	26,94	56
57	50,33	26,76	50,21	26,98	50,09	27,20	49,97	27,42	57
58	51,21	27,23	51,09	27,45	50,97	27,68	50,85	27,90	58
59	52,09	27,70	51,97	27,93	51,85	28,15	51,73	28,38	59
60	52,98	28,17	52,85	28,40	52,73	28,63	52,60	28,86	60
61	53,86	28,64	53,73	28,87	53,61	29,11	53,48	29,34	61
62	54,74	29,11	54,62	29,35	54,49	29,58	54,36	29,82	62
63	55,63	29,58	55,50	29,82	55,37	30,06	55,23	30,30	63
64	56,51	30,05	56,38	30,29	56,24	30,54	56,11	30,78	64
65	57,39	30,52	57,26	30,77	57,12	31,02	56,99	31,26	65
66	58,27	30,99	58,14	31,24	58,00	31,49	57,86	31,75	66
67	59,16	31,45	59,02	31,71	58,88	31,97	58,74	32,23	67
68	60,04	31,92	59,90	32,19	59,76	32,45	59,62	32,71	68
69	60,92	32,39	60,78	32,66	60,64	32,92	60,49	33,19	69
70	61,81	32,86	61,66	33,13	61,52	33,40	61,37	33,67	70
71	62,69	33,33	62,54	33,61	62,40	33,88	62,25	34,15	71
72	63,57	33,80	63,42	34,08	63,27	34,36	63,12	34,63	72
73	64,46	34,27	64,30	34,55	64,15	34,83	64,00	35,11	73
74	65,34	34,74	65,19	35,03	65,03	35,31	64,88	35,59	74
75	66,22	35,21	66,07	35,50	65,91	35,79	65,75	36,07	75
76	67,10	35,68	66,95	35,97	66,79	36,26	66,63	36,56	76
77	67,99	36,15	67,83	36,45	67,67	36,74	67,51	37,04	77
78	68,87	36,62	68,71	36,92	68,55	37,22	68,38	37,52	78
79	69,75	37,09	69,59	37,39	69,43	37,70	69,26	38,00	79
80	70,64	37,56	70,47	37,87	70,31	38,17	70,14	38,48	80
81	71,52	38,03	71,35	38,34	71,18	38,65	71,01	38,96	81
82	72,40	38,50	72,23	38,81	72,06	39,13	71,89	39,44	82
83	73,28	38,97	73,11	39,29	72,94	39,60	72,77	39,92	83
84	74,17	39,44	73,99	39,76	73,82	40,08	73,64	40,40	84
85	75,05	39,91	74,88	40,23	74,70	40,56	74,52	40,88	85
86	75,93	40,37	75,76	40,71	75,58	41,04	75,40	41,36	86
87	76,82	40,84	76,64	41,18	76,46	41,51	76,28	41,85	87
88	77,70	41,31	77,52	41,65	77,34	41,99	77,15	42,33	88
89	78,58	41,78	78,40	42,13	78,21	42,47	78,03	42,81	89
90	79,47	42,25	79,28	42,60	79,09	42,94	78,91	43,29	90
91	80,35	42,72	80,16	43,07	79,97	43,42	79,78	43,77	91
92	81,23	43,19	81,04	43,55	80,85	43,90	80,66	44,25	92
93	82,11	43,66	81,92	44,02	81,73	44,38	81,54	44,73	93
94	83,00	44,13	82,80	44,49	82,61	44,85	82,41	45,21	94
95	83,88	44,60	83,68	44,97	83,49	45,33	83,29	45,69	95
96	84,76	45,07	84,57	45,44	84,37	45,81	84,17	46,17	96
97	85,65	45,54	85,45	45,91	85,25	46,28	85,04	46,66	97
98	86,53	46,01	86,33	46,39	86,12	46,76	85,92	47,14	98
99	87,41	46,48	87,21	46,86	87,00	47,24	86,80	47,62	99
100	88,29	46,95	88,09	47,33	87,88	47,72	87,67	48,10	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep	Lat.	Dep.	Lat	Dist.
	62 Deg.		61¾ Deg.		61½ Deg.		61¼ Deg.		

Dist.	29 Deg.		29¼ Deg.		29½ Deg.		29¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,87	0,48	0,87	0,49	0,87	0,49	0,87	0,50	1
2	1,75	0,97	1,74	0,98	1,74	0,98	1,74	0,99	2
3	2,62	1,45	2,62	1,47	2,61	1,48	2,60	1,49	3
4	3,50	1,94	3,49	1,95	3,48	1,97	3,47	1,98	4
5	4,37	2,42	4,36	2,44	4,35	2,46	4,34	2,48	5
6	5,25	2,91	5,23	2,93	5,22	2,95	5,21	2,98	6
7	6,12	3,39	6,11	3,42	6,09	3,45	6,08	3,47	7
8	7,00	3,88	6,98	3,91	6,96	3,94	6,95	3,97	8
9	7,87	4,36	7,85	4,40	7,83	4,43	7,81	4,47	9
10	8,75	4,85	8,72	4,89	8,70	4,92	8,68	4,96	10
11	9,62	5,33	9,60	5,37	9,57	5,42	9,55	5,46	11
12	10,50	5,82	10,47	5,86	10,44	5,91	10,42	5,95	12
13	11,37	6,30	11,34	6,35	11,31	6,40	11,29	6,45	13
14	12,24	6,79	12,21	6,84	12,18	6,89	12,15	6,95	14
15	13,12	7,27	13,09	7,33	13,06	7,39	13,02	7,44	15
16	13,99	7,76	13,96	7,82	13,93	7,88	13,89	7,94	16
17	14,87	8,24	14,83	8,31	14,80	8,37	14,76	8,44	17
18	15,74	8,73	15,70	8,80	15,67	8,86	15,63	8,93	18
19	16,62	9,21	16,58	9,28	16,54	9,36	16,50	9,43	19
20	17,49	9,70	17,45	9,77	17,41	9,85	17,36	9,92	20
21	18,37	10,18	18,32	10,26	18,28	10,34	18,23	10,42	21
22	19,24	10,67	19,19	10,75	19,15	10,83	19,10	10,92	22
23	20,12	11,15	20,07	11,24	20,02	11,33	19,97	11,41	23
24	20,99	11,64	20,94	11,73	20,89	11,82	20,84	11,91	24
25	21,87	12,12	21,81	12,22	21,76	12,31	21,70	12,41	25
26	22,74	12,60	22,68	12,70	22,63	12,80	22,57	12,90	26
27	23,61	13,09	23,56	13,19	23,50	13,30	23,44	13,40	27
28	24,49	13,57	24,43	13,68	24,37	13,79	24,31	13,89	28
29	25,36	14,06	25,30	14,17	25,24	14,28	25,18	14,39	29
30	26,24	14,54	26,17	14,66	26,11	14,77	26,05	14,89	30
31	27,11	15,03	27,05	15,15	26,98	15,27	26,91	15,38	31
32	27,99	15,51	27,92	15,64	27,85	15,76	27,78	15,88	32
33	28,86	16,00	28,79	16,12	28,72	16,25	28,65	16,38	33
34	29,74	16,48	29,66	16,61	29,59	16,74	29,52	16,87	34
35	30,61	16,97	30,54	17,10	30,46	17,23	30,39	17,37	35
36	31,49	17,45	31,41	17,59	31,33	17,73	31,26	17,86	36
37	32,36	17,94	32,28	18,08	32,20	18,22	32,12	18,36	37
38	33,24	18,42	33,15	18,57	33,07	18,71	32,99	18,86	38
39	34,11	18,91	34,03	19,06	33,94	19,20	33,86	19,35	39
40	34,98	19,39	34,90	19,54	34,81	19,70	34,73	19,85	40
41	35,86	19,88	35,77	20,03	35,68	20,19	35,60	20,34	41
42	36,73	20,36	36,64	20,52	36,55	20,68	36,46	20,84	42
43	37,61	20,85	37,52	21,01	37,43	21,17	37,33	21,34	43
44	38,48	21,33	38,39	21,50	38,30	21,67	38,20	21,83	44
45	39,36	21,82	39,26	21,99	39,17	22,16	39,07	22,33	45
46	40,23	22,30	40,13	22,48	40,04	22,65	39,94	22,83	46
47	41,11	22,79	41,01	22,97	40,91	23,14	40,81	23,32	47
48	41,98	23,27	41,88	23,45	41,78	23,63	41,67	23,82	48
49	42,86	23,76	42,75	23,94	42,65	24,13	42,54	24,31	49
50	43,73	24,24	43,62	24,43	43,52	24,62	43,41	24,81	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	61 Deg.		60¾ Deg.		60½ Deg.		60¼ Deg.		

Dist.	29 Deg. Lat.	29 Deg. Dep.	29¼ Deg. Lat.	29¼ Deg. Dep.	29½ Deg. Lat.	29½ Deg. Dep.	29¾ Deg. Lat.	29¾ Deg. Dep.	Dist.
51	44,61	24,73	44,50	24,92	44,39	25,11	44,28	25,31	51
52	45,48	25,21	45,37	25,41	45,26	25,61	45,15	25,80	52
53	46,35	25,69	46,24	25,90	46,13	26,10	46,01	26,30	53
54	47,23	26,18	47,11	26,39	47,00	26,59	46,88	26,80	54
55	48 10	26,66	47,99	26,87	47,87	27,08	47,75	27,29	55
56	48,98	27,15	48,86	27,36	48,74	27,58	48,62	27,79	56
57	49,85	27,63	49,73	27,85	49,61	28,07	49,49	28,28	57
58	50,73	28,12	50,60	28,34	50,48	28,56	50,36	28,78	58
59	51,60	28,60	51,48	28,83	51,35	29,05	51,22	29,28	59
60	52,48	29,09	52,35	29,32	52,22	29,55	52,09	29,77	60
61	53,35	29,57	53,22	29,81	53,09	30,04	52,96	30,27	61
62	54,23	30,06	54,09	30,29	53,96	30,53	53,83	30,77	62
63	55,10	30,54	54,97	30,78	54,83	31,02	54,70	31,26	63
64	55,98	31,03	55,84	31,27	55,70	31,52	55,56	31,76	64
65	56,85	31,51	56,71	31,76	56,57	32,01	56,43	32,25	65
66	57,72	32,00	57,58	32,25	57,44	32,50	57,30	32,75	66
67	58,60	32,48	58,46	32,74	58,31	32,99	58,17	33,25	67
68	59,47	32,97	59,33	33,23	59,18	33,48	59,04	33,74	68
69	60,35	33,45	60,20	33,71	60,05	33,98	59,91	34,24	69
70	61,22	33,94	61,07	34,20	60,92	34,47	60,77	34,74	70
71	62,10	34,42	61,95	34,69	61,80	34,96	61,64	35,23	71
72	62,97	34,91	62,82	35,18	62,67	35,45	62,51	35,73	72
73	63,85	35,39	63,69	35,67	63,54	35,95	63,38	36,22	73
74	64,72	35,88	64,56	36,16	64,41	36,44	64,25	36,72	74
75	65,60	36,36	65,44	36,65	65,28	36,93	65,11	37,22	75
76	66,47	36,85	66,31	37,14	66,15	37,42	65,98	37,71	76
77	67,35	37,33	67,18	37,62	67,02	37,92	66,85	38,21	77
78	68,22	37,82	68,05	38,11	67,89	38,41	67,72	38,70	78
79	69,09	38,30	68,93	38,60	68,76	38,90	68,59	39,20	79
80	69,97	38,78	69,80	39,09	69,63	39,39	69,46	39,70	80
81	70,84	39,27	70,67	39,58	70,50	39,89	70,32	40,19	81
82	71,72	39,75	71,54	40,07	71,37	40,38	71,19	40,69	82
83	72,59	40,24	72,42	40,56	72,24	40,87	72,06	41,19	83
84	73,47	40,72	73,29	41,04	73,11	41,36	72,93	41,68	84
85	74,34	41,21	74,16	41,53	73,98	41,86	73,80	42,18	85
86	75,22	41,69	75,03	42,02	74,85	42,35	74,67	42,67	86
87	76,09	42,18	75,91	42,51	75,72	42,84	75,53	43,17	87
88	76,97	42,66	76,78	43,00	76,59	43,33	76,40	43,67	88
89	77,84	43,15	77,65	43,49	77,46	43,83	77,27	44,16	89
90	78,72	43,63	78,52	43,98	78,33	44,32	78,14	44,66	90
91	79,59	44,12	79,40	44,46	79,20	44,81	79,01	45,16	91
92	80,46	44,60	80,27	44,95	80,07	45,30	79,87	45,65	92
93	81,34	45,09	81,14	45,44	80,94	45,80	80,74	46,15	93
94	82,21	45,57	82,01	45,93	81,81	46,29	81,61	46,64	94
95	83,09	46,06	82,89	46,42	82,68	46,78	82,48	47,14	95
96	83,96	46,54	83,76	46,91	83,55	47,27	83,35	47,64	96
97	84,84	47,03	84,63	47,40	84,42	47,77	84,22	48,13	97
98	85,71	47,51	85,50	47,88	85,29	48,26	85,08	48,63	98
99	86,59	48,00	86,38	48,37	86,17	48,75	85,95	49,17	99
100	87,46	48,48	87,25	48,86	87,04	49,24	86,82	49,62	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	61 Deg.		60¾ Deg.		60½ Deg.		60¼ Deg.		

Dist.	30 Deg.		30¼ Deg.		30½ Deg.		30¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,87	0,50	0,86	0,50	0,86	0,51	0,86	0,51	1
2	1,73	1,00	1,73	1,01	1,72	1,02	1,72	1,02	2
3	2,60	1,50	2,59	1,51	2,58	1,52	2,58	1,53	3
4	3,46	2,00	3,46	2,02	3,45	2,03	3,44	2,05	4
5	4,33	2,50	4,32	2,52	4,31	2,54	4,30	2,56	5
6	5,20	3,00	5,18	3,02	5,17	3,05	5,16	3,07	6
7	6,06	3,50	6,05	3,53	6,03	3,55	6,02	3,58	7
8	6,93	4,00	6,91	4,03	6,89	4,06	6,88	4,09	8
9	7,79	4,50	7,77	4,53	7,75	4,57	7,73	4,60	9
10	8,66	5,00	8,64	5,04	8,62	5,08	8,59	5,11	10
11	9,53	5,50	9,50	5,54	9,48	5,58	9,45	5,62	11
12	10,39	6,00	10,37	6,05	10,34	6,09	10,31	6,14	12
13	11,26	6,50	11,23	6,55	11,20	6,60	11,17	6,65	13
14	12,12	7,00	12,09	7,05	12,06	7,11	12,03	7,16	14
15	12,99	7,50	12,96	7,56	12,92	7,61	12,89	7,67	15
16	13,86	8,00	13,82	8,06	13,79	8,12	13,75	8,18	16
17	14,72	8,50	14,69	8,56	14,65	8,63	14,61	8,69	17
18	15,59	9,00	15,55	9,07	15,51	9,14	15,47	9,20	18
19	16,45	9,50	16,41	9,57	16,37	9,64	16,33	9,71	19
20	17,32	10,00	17,28	10,08	17,23	10,15	17,19	10,23	20
21	18,19	10,50	18,14	10,58	18,09	10,66	18,05	10,74	21
22	19,05	11,00	19,00	11,08	18,96	11,17	18,91	11,25	22
23	19,92	11,50	19,87	11,59	19,82	11,67	19,77	11,76	23
24	20,78	12,00	20,73	12,09	20,68	12,18	20,63	12,27	24
25	21,65	12,50	21,60	12,59	21,54	12,69	21,49	12,78	25
26	22,52	13,00	22,46	13,10	22,40	13,20	22,34	13,29	26
27	23,38	13,50	23,32	13,60	23,26	13,70	23,20	13,80	27
28	24,25	14,00	24,19	14,11	24,13	14,21	24,06	14,32	28
29	25,11	14,50	25,05	14,61	24,99	14,72	24,92	14,83	29
30	25,98	15,00	25,92	15,11	25,85	15,23	25,78	15,34	30
31	26,85	15,50	26,78	15,62	26,71	15,73	26,64	15,85	31
32	27,71	16,00	27,64	16,12	27,57	16,24	27,50	16,36	32
33	28,58	16,50	28,51	16,62	28,43	16,75	28,36	16,87	33
34	29,44	17,00	29,37	17,13	29,30	17,26	29,22	17,38	34
35	30,31	17,50	30,23	17,63	30,16	17,76	30,08	17,90	35
36	31,18	18,00	31,10	18,14	31,02	18,27	30,94	18,41	36
37	32,04	18,50	31,96	18,64	31,88	18,78	31,80	18,92	37
38	32,91	19,00	32,83	19,14	32,74	19,29	32,66	19,43	38
39	33,77	19,50	33,69	19,65	33,60	19,79	33,52	19,94	39
40	34,64	20,00	34,5[illegible]	20,15	34,47	20,30	34,38	20,45	40
41	35,51	20,50	35,4[illegible]	20,65	35,33	20,81	35,24	20,96	41
42	36,37	21,00	36,28	21,16	36,19	21,32	36,10	21,47	42
43	37,24	21,50	37,14	21,66	37,05	21,82	36,95	21,99	43
44	38,11	22,00	38,01	22,17	37,91	22,33	37,81	22,50	44
45	38,97	22,50	38,87	22,67	38,77	22,84	38,67	23,01	45
46	39,8[illegible]	23,00	39,74	23,17	39,63	23,35	39,53	23,52	46
47	40,70	23,50	40,60	23,68	40,50	23,85	40,39	24,03	47
48	41,5[illegible]	24,00	41,46	24,18	41,36	24,36	41,25	24,54	48
49	42,44	24,50	42,33	24,68	42,22	24,87	42,11	25,05	49
50	43,30	25,00	43,19	25,19	43,08	[illegible],38	42,97	25,56	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	60 Deg.		59¾ Deg.		59½ Deg.		59¼ Deg.		

Dist.	30 Deg. Lat.	30 Deg. Dep.	30¼ Deg. Lat.	30¼ Deg. Dep.	30½ Deg. Lat.	30½ Deg. Dep.	30¾ Deg. Lat.	30¾ Deg. Dep.	Dist.
51	44,17	25,50	44,06	25,69	43,94	25,88	43,83	26,08	51
52	45,03	26,00	44,92	26,20	44,80	26,39	44,69	26,59	52
53	45,90	26,50	45,78	26,70	45,67	26,90	45,55	27,10	53
54	46,77	27,00	46,65	27,20	46,53	27,41	46,41	27,61	54
55	47,63	27,50	47,51	27,71	47,39	27,91	47,27	28,12	55
56	48,50	28,00	48,37	28,21	48,25	28,42	48,13	28,63	56
57	49,36	28,50	49,24	28,72	49,11	28,93	48,99	29,14	57
58	50,23	29,00	50,10	29,22	49,97	29,44	49,85	29,65	58
59	51,10	29,50	50,97	29,72	50,84	29,94	50,70	30,17	59
60	51,96	30,00	51,83	30,23	51,70	30,45	51,56	30,68	60
61	52,83	30,50	52,69	30,73	52,56	30,96	52,42	31,19	61
62	53,69	31,00	53,56	31,23	53,42	31,47	53,28	31,70	62
63	54,56	31,50	54,42	31,74	54,28	31,97	54,14	32,21	63
64	55,43	32,00	55,29	32,24	55,14	32,48	55,00	32,72	64
65	56,29	32,50	56,15	32,75	56,01	32,99	55,86	33,23	65
66	57,16	33,00	57,01	33,25	56,87	33,50	56,72	33,75	66
67	58,02	33,50	57,88	33,75	57,73	34,01	57,58	34,26	67
68	58,89	34,00	58,74	34,26	58,59	34,51	58,44	34,77	68
69	59,76	34,50	59,60	34,76	59,45	35,02	59,30	35,28	69
70	60,62	35,00	60,47	35,26	60,31	35,53	60,16	35,79	70
71	61,49	35,50	61,33	35,77	61,18	36,04	61,02	36,30	71
72	62,35	36,00	62,20	36,27	62,04	36,54	61,88	36,81	72
73	63,22	36,50	63,06	36,78	62,90	37,05	62,74	37,32	73
74	64,09	37,00	63,92	37,28	63,76	37,56	63,60	37,84	74
75	64,95	37,50	64,79	37,78	64,62	38,07	64,46	38,35	75
76	65,82	38,00	65,65	38,29	65,48	38,57	65,31	38,86	76
77	66,68	38,50	66,52	38,79	66,35	39,08	66,17	39,37	77
78	67,55	39,00	67,38	39,29	67,21	39,59	67,03	39,88	78
79	68,42	39,50	68,24	39,80	68,07	40,10	67,89	40,39	79
80	69,28	40,00	69,11	40,30	68,93	40,60	68,75	40,90	80
81	70,15	40,50	69,97	40,81	69,79	41,11	69,61	41,41	81
82	71,01	41,00	70,83	41,31	70,65	41,62	70,47	41,93	82
83	71,88	41,50	71,70	41,81	71,52	42,13	71,33	42,44	83
84	72,75	42,00	72,56	42,32	72,38	42,63	72,19	42,95	84
85	73,61	42,50	73,43	42,82	73,24	43,14	73,05	43,46	85
86	74,48	43,00	74,29	43,32	74,10	43,65	73,91	43,97	86
87	75,34	43,50	75,15	43,83	74,96	44,16	74,77	44,48	87
88	76,21	44,00	76,02	44,33	75,82	44,66	75,63	44,99	88
89	77,08	44,50	76,88	44,84	76,68	45,17	76,49	45,51	89
90	77,94	45,00	77,75	45,34	77,55	45,68	77,35	46,02	90
91	78,81	45,50	78,61	45,84	78,41	46,19	78,21	46,53	91
92	79,67	46,00	79,47	46,35	79,27	46,69	79,07	47,04	92
93	80,54	46,50	80,34	46,85	80,13	47,20	79,92	47,55	93
94	81,41	47,00	81,20	47,35	80,99	47,71	80,78	48,06	94
95	82,27	47,50	82,06	47,86	81,85	48,22	81,64	48,57	95
96	83,14	48,00	82,93	48,36	82,72	48,72	82,50	49,08	96
97	84,00	48,50	83,79	48,87	83,58	49,23	83,36	49,60	97
98	84,87	49,00	84,66	49,37	84,44	49,74	84,22	50,11	98
99	85,74	49,50	85,52	49,87	85,30	50,25	85,08	50,62	99
100	86,60	50,00	86,38	50,38	86,16	50,75	85,94	51,13	100
Dist.	Dep. 60 Deg.	Lat. 60 Deg.	Dep. 59¾ Deg.	Lat. 59¾ Deg.	Dep. 59½ Deg.	Lat. 59½ Deg.	Dep. 59¼ Deg.	Lat. 59¼ Deg.	Dist.

Dist.	31 Deg.		31¼ Deg.		31½ Deg.		31¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,86	0,51	0,85	0,52	0,85	0,52	0,85	0,53	1
2	1,71	1,03	1,71	1,04	1,71	1,04	1,70	1,05	2
3	2,57	1,55	2,56	1,56	2,56	1,57	2,55	1,58	3
4	3,43	2,06	3,42	2,08	3,41	2,09	3,40	2,10	4
5	4,29	2,58	4,27	2,59	4,26	2,61	4,25	2,63	5
6	5,14	3,09	5,13	3,11	5,12	3,13	5,10	3,16	6
7	6,00	3,61	5,98	3,63	5,97	3,66	5,95	3,68	7
8	6,86	4,12	6,84	4,15	6,82	4,18	6,80	4,21	8
9	7,71	4,64	7,69	4,67	7,67	4,70	7,65	4,74	9
10	8,57	5,15	8,55	5,19	8,53	5,22	8,50	5,26	10
11	9,43	5,67	9,40	5,71	9,38	5,75	9,35	5,79	11
12	10,29	6,18	10,26	6,23	10,23	6,27	10,20	6,31	12
13	11,14	6,70	11,11	6,74	11,08	6,79	11,05	6,84	13
14	12,00	7,21	11,97	7,26	11,94	7,31	11,90	7,37	14
15	12,86	7,73	12,82	7,78	12,79	7,84	12,76	7,89	15
16	13,71	8,24	13,68	8,30	13,64	8,36	13,61	8,42	16
17	14,57	8,76	14,53	8,82	14,49	8,88	14,46	8,95	17
18	15,43	9,27	15,39	9,34	15,35	9,40	15,31	9,47	18
19	16,29	9,79	16,24	9,86	16,20	9,93	16,16	10,00	19
20	17,14	10,30	17,10	10,38	17,05	10,45	17,01	10,52	20
21	18,00	10,82	17,95	10,89	17,91	10,97	17,86	11,05	21
22	18,86	11,33	18,81	11,41	18,76	11,49	18,71	11,58	22
23	19,71	11,85	19,66	11,93	19,61	12,02	19,56	12,10	23
24	20,57	12,36	20,52	12,45	20,46	12,54	20,41	12,63	24
25	21,43	12,88	21,37	12,97	21,32	13,06	21,26	13,16	25
26	22,29	13,39	22,23	13,49	22,17	13,58	22,11	13,68	26
27	23,14	13,91	23,08	14,01	23,02	14,11	22,96	14,21	27
28	24,00	14,42	23,94	14,53	23,87	14,63	23,81	14,73	28
29	24,86	14,94	24,79	15,04	24,73	15,15	24,66	15,26	29
30	25,71	15,45	25,65	15,56	25,58	15,67	25,51	15,79	30
31	26,57	15,97	26,50	16,08	26,43	16,20	26,36	16,31	31
32	27,43	16,48	27,36	16,60	27,28	16,72	27,21	16,84	32
33	28,29	17,00	28,21	17,12	28,14	17,24	28,06	17,37	33
34	29,14	17,51	29,07	17,64	28,99	17,76	28,91	17,89	34
35	30,00	18,03	29,92	18,16	29,84	18,29	29,76	18,42	35
36	30,86	18,54	30,78	18,68	30,70	18,81	30,61	18,94	36
37	31,72	19,06	31,63	19,19	31,55	19,33	31,46	19,47	37
38	32,57	19,57	32,49	19,71	32,40	19,85	32,31	20,00	38
39	33,43	20,09	33,34	20,23	33,25	20,38	33,16	20,52	39
40	34,29	20,60	34,20	20,75	34,11	20,90	34,01	21,05	40
41	35,14	21,12	35,05	21,27	34,96	21,42	34,86	21,57	41
42	36,00	21,63	35,91	21,79	35,81	21,94	35,71	22,10	42
43	36,86	22,15	36,76	22,31	36,66	22,47	36,57	22,63	43
44	37,72	22,66	37,62	22,83	37,52	22,99	37,42	23,15	44
45	38,57	23,18	38,47	23,34	38,37	23,51	38,27	23,68	45
46	39,43	23,69	39,33	23,86	39,22	24,03	39,12	24,21	46
47	40,29	24,21	40,18	24,38	40,07	24,56	39,97	24,73	47
48	41,14	24,72	41,04	24,90	40,93	25,08	40,82	25,26	48
49	42,00	25,24	41,89	25,42	41,78	25,60	41,67	25,78	49
50	42,86	25,75	42,75	25,94	42,63	26,12	42,52	26,31	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	59 Deg.		58¾ Deg.		58½ Deg.		58¼ Deg.		

Dist.	31 Deg. Lat.	31 Deg. Dep.	31¼ Deg. Lat.	31¼ Deg. Dep.	31½ Deg. Lat.	31½ Deg. Dep.	31¾ Deg. Lat.	31¾ Deg. Dep.	Dist.
51	43,72	26,27	43,60	26,46	43,48	26,65	43,37	26,84	51
52	44,57	26,78	44,46	26,98	44,34	27,17	44,22	27,36	52
53	45,43	27,30	45,31	27,49	45,19	27,69	45,07	27,89	53
54	46,29	27,81	46,17	28,01	46,04	28,21	45,92	28,42	54
55	47,14	28,33	47,02	28,53	46,90	28,74	46,77	28,94	55
56	48 00	28,84	47,88	29,05	47,75	29,26	47,62	29,47	56
57	48,86	29,36	48,73	29,57	48,60	29,78	48,47	29,99	57
58	49,72	29,87	49,58	30,09	49,45	30,30	49,32	30,52	58
59	50,57	30,39	50,44	30,61	50,31	30,83	50,17	31,05	59
60	51,43	30,90	51,29	31,13	51,16	31,35	51,02	31,57	60
61	52,29	31,42	52,15	31,65	52,01	31,87	51,87	32,10	61
62	53,14	31,93	53,00	32,16	52,86	32,39	52,72	32,63	62
63	54,00	32,45	53,86	32,68	53,72	32,92	53,57	33,15	63
64	54,86	32,96	54,71	33,20	54,57	33,44	54,42	33,68	64
65	55,72	33,48	55,57	33,72	55,42	33,96	55,27	34,20	65
66	56,57	33,99	56,42	34,24	56,27	34,48	56,12	34,73	66
67	57,43	34,51	57,28	34,76	57,13	35,01	56,98	35,26	67
68	58,29	35,02	58,13	35,28	57,98	35,53	57,82	35,78	68
69	59,14	35,54	58,99	35,80	58,83	36,05	58,67	36,31	69
70	60,00	36,05	59,84	36,31	59,68	36,57	59,52	36,83	70
71	60,86	36,57	60,70	36,83	60,54	37,10	60,37	37,36	71
72	61,72	37,08	61,55	37,35	61,39	37,62	61,23	37,89	72
73	62,57	37,60	62,41	37,87	62,24	38,14	62,08	38,41	73
74	63,43	38,11	63,26	38,39	63,10	38,66	62,93	38,94	74
75	64,29	38,63	64,12	38,91	63,95	39,19	63,78	39,47	75
76	65,14	39,14	64,97	39,43	64,80	39,71	64,63	39,99	76
77	66,00	39,66	65,83	39,95	65,65	40,23	65,48	40,52	77
78	66,86	40,17	66,68	40,46	66,51	40,75	66,33	41,04	78
79	67,72	40,69	67,54	40,98	67,36	41,28	67,18	41,57	79
80	68,57	41 20	68,39	41,50	68,21	41,80	68,03	42,10	80
81	69,43	41,72	69,25	42,02	69,06	42,32	68,88	42,62	81
82	70,29	42,23	70,10	42,54	69,92	42,84	69,73	43,15	82
83	71,14	42,75	70,96	43,06	70,77	43,37	70,58	43,68	83
84	72,00	43,26	71,81	43,58	71,62	43,89	71,43	44,20	84
85	72,86	43,78	72,67	44,10	72,47	44,41	72,28	44,73	85
86	73,72	44,29	73,52	44,61	73,33	44,93	73,13	45,25	86
87	74,57	44,81	74,38	45,13	74,18	45,46	73,98	45,78	87
88	75,43	45,32	75,23	45,65	75,03	45,98	74,83	46,31	88
89	76,29	45,84	76,09	46,17	75,88	46,50	75,68	46,83	89
90	77,15	46,35	76,94	46,69	76,74	47,02	76,53	47,36	90
91	78,00	46,87	77,80	47,21	77,59	47,55	77,38	47,89	91
92	78,86	47,38	78,65	47,73	78,44	48,07	78,23	48,41	92
93	79,72	47,90	79,51	48,25	79,30	48,59	79,08	48,94	93
94	80,57	48,41	80,36	48,76	80,15	49,11	79,93	49,47	94
95	81,43	48,93	81,22	49,28	81,00	49,64	80,78	49,99	95
96	82,29	49,44	82,07	49,80	81,85	50,16	81,63	50,52	96
97	83,15	49,96	82,93	50,32	82,71	50,68	82,48	51,04	97
98	84,00	50,47	83,78	50,84	83,56	51,20	83,33	51,57	98
99	84,86	50,99	84,64	51,36	84,41	51,73	84,18	52,10	99
100	85,72	51,50	85,49	51,88	85,26	52,25	85,04	52,62	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	59 Deg.		58¾ Deg.		58½ Deg.		58¼ Deg.		

Dist.	32 Deg.		32¼ Deg.		32½ Deg.		32¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,85	0,53	0,85	0,53	0,84	0,54	0,84	0,54	1
2	1,70	1,06	1,69	1,07	1,69	1,07	1,68	1,08	2
3	2,54	1,59	2,54	1,60	2,53	1,61	2,52	1,62	3
4	3 39	2,12	3,38	2,13	3,37	2,15	3,36	2,16	4
5	4,24	2,65	4,23	2,67	4,22	2,69	4,21	2,70	5
6	5,09	3,18	5,07	3,20	5,06	3,22	5,05	3,25	6
7	5,94	3,71	5,92	3,74	5,90	3,76	5,89	3,79	7
8	6,78	4,24	6,77	4,27	6,75	4,30	6,73	4,33	8
9	7,63	4,77	7,61	4,80	7,59	4,84	7,57	4,87	9
10	8,48	5,30	8,46	5,34	8,43	5,37	8,41	5,41	10
11	9,33	5,83	9,30	5,87	9,28	5,91	9,25	5,95	11
12	10,18	6,36	10,15	6,40	10,12	6,45	10,09	6,49	12
13	11,02	6,89	10,99	6,94	10,96	6,98	10,93	7,03	13
14	11,87	7,42	11,84	7,47	11,81	7,52	11,77	7,57	14
15	12,72	7,95	12,69	8,00	12,65	8,06	12,62	8,11	15
16	13,57	8,48	13,53	8,54	13,49	8,60	13,46	8,66	16
17	14,42	9,01	14,38	9,07	14,34	9,13	14,30	9,20	17
18	15,26	9,54	15,22	9,61	15,18	9,67	15,14	9,74	18
19	16,11	10,07	16,07	10,14	16,02	10,21	15,98	10,28	19
20	16,96	10,60	16,91	10,67	16,87	10,75	16,82	10,82	20
21	17,81	11,13	17,76	11,21	17,71	11,28	17,66	11,36	21
22	18,66	11,66	18,61	11,74	18,55	11,82	18,50	11,90	22
23	19,51	12,19	19,45	12,27	19,40	12,36	19,34	12,44	23
24	20,35	12,72	20,30	12,81	20,24	12,90	20,18	12,98	24
25	21,20	13,25	21,14	13,34	21,08	13,43	21,03	13,52	25
26	22,05	13,78	21,99	13,87	21,93	13,97	21,87	14,07	26
27	22,90	14,31	22,83	14,41	22,77	14,51	22,71	14,61	27
28	23,75	14,84	23,68	14,94	23,61	15,04	23,55	15,15	28
29	24,59	15,37	24,53	15,47	24,46	15,58	24,39	15,69	29
30	25,44	15,90	25,37	16,01	25,30	16,12	25,23	16,23	30
31	26,29	16,43	26,22	16,54	26,15	16,66	26,07	16,77	31
32	27,14	16,96	27,06	17,08	26,99	17,19	26,91	17,31	32
33	27,99	17,49	27,91	17,61	27,83	17,73	27,75	17,85	33
34	28,83	18,02	28,75	18,14	28,68	18,27	28,60	18,39	34
35	29,68	18,55	29,60	18,68	29,52	18,81	29,44	18,93	35
36	30,53	19,08	30,45	19,21	30,36	19,34	30,28	19,48	36
37	31,38	19,61	31,29	19,74	31,21	19,88	31,12	20,02	37
38	32,23	20,14	32,14	20,28	32,05	20,42	31,96	20,56	38
39	33,07	20,67	32,98	20,81	32,89	20,95	32,80	21,10	39
40	33,92	21,20	33,83	21,34	33,74	21,49	33,64	21,64	40
41	34,77	21,73	34,67	21,88	34,58	22,03	34,48	22,18	41
42	35,62	22,26	35,52	22,41	35,42	22,57	35,32	22,72	42
43	36,47	22,79	36,37	22,95	36,27	23,10	36,16	23,26	43
44	37,31	23,32	37,21	23,48	37,11	23,64	37,01	23,80	44
45	38,16	23,85	38,06	24,01	37,95	24,18	37,85	24,34	45
46	39,01	24,38	38,90	24,55	38,80	24,72	38,69	24,88	46
47	39,86	24,91	39,75	25,08	39,64	25,25	39,53	25,43	47
48	40,71	25,44	40,59	25 61	40,48	25,79	40,37	25,97	48
49	41,55	25,97	41,44	26,15	41,33	26,33	41,21	26,51	49
50	42,40	26,50	42,29	26,68	42,17	26,86	42,05	27,05	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	58 Deg.		57¾ Deg.		57½ Deg.		57¼ Deg.		

Dist.	32 Deg.		32¼ Deg.		32½ Deg.		32¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	43,25	27,03	43,13	27,21	43,01	27,40	42,89	27,59	51
52	44,10	27,56	43,98	27,75	43,86	27,94	43,73	28,13	52
53	44,95	28,09	44,82	28,28	44,70	28,48	44,58	28,67	53
54	45,79	28,62	45,67	28,82	45,54	29,01	45,42	29,21	54
55	46,64	29,15	46,51	29,35	46,39	29,55	46,26	29,75	55
56	47,49	29,68	47,36	29,88	47,23	30,09	47,10	30,29	56
57	48,34	30,21	48,21	30,42	48,07	30,63	47,94	30,84	57
58	49,19	30,74	49,05	30,95	48,92	31,16	48,78	31,38	58
59	50,03	31,27	49,90	31,48	49,76	31,70	49,62	31,92	59
60	50,88	31,80	50,74	32,02	50,60	32,24	50,46	32,46	60
61	51,73	32,33	51,59	32,55	51,45	32,78	51,30	33,00	61
62	52,58	32,85	52,44	33,08	52,29	33,31	52,14	33,54	62
63	53,43	33,38	53,28	33,62	53,13	33,85	52,99	34,08	63
64	54,28	33,91	54,13	34,15	53,98	34,39	53,83	34,62	64
65	55,12	34,44	54,97	34,68	54,82	34,92	54,67	35,16	65
66	55,97	34,97	55,82	35,22	55,66	35,46	55,51	35,70	66
67	56,82	35,50	56,66	35,75	56,51	36,00	56,35	36,25	67
68	57,67	36,03	57,51	36,29	57,35	36,54	57,19	36,79	68
69	58,52	36,56	58,36	36,82	58,19	37,07	58,03	37,33	69
70	59,36	37,09	59,20	37,35	59,04	37,61	58,87	37,87	70
71	60,21	37,62	60,05	37,89	59,88	38,15	59,71	38,41	71
72	61,06	38,15	60,89	38,42	60,72	38,69	60,55	38,95	72
73	61,91	38,68	61,74	38,95	61,57	39,22	61,40	39,49	73
74	62,76	39,21	62,58	39,49	62,41	39,76	62,24	40,03	74
75	63,60	39,74	63,43	40,02	63,25	40,30	63,08	40,57	75
76	64,45	40,27	64,28	40,55	64,10	40,83	63,92	41,11	76
77	65,30	40,80	65,12	41,09	64,94	41,37	64,76	41,65	77
78	66,15	41,33	65,97	41,62	65,78	41,91	65,60	42,20	78
79	67,00	41,86	66,81	42,16	66,63	42,45	66,44	42,74	79
80	67,84	42,39	67,66	42,69	67,47	42,98	67,28	43,28	80
81	68,69	42,92	68,50	43,22	68,31	43,52	68,12	43,82	81
82	69,54	43,45	69,35	43,76	69,16	44,06	68,97	44,36	82
83	70,39	43,98	70,20	44,29	70,00	44,60	69,81	44,90	83
84	71,24	44,51	71,04	44,82	70,84	45,13	70,65	45,44	84
85	72,08	45,04	71,89	45,36	71,69	45,67	71,49	45,98	85
86	72,93	45,57	72,73	45,89	72,53	46,21	72,33	46,52	86
87	73,78	46,10	73,58	46,42	73,38	46,75	73,17	47,06	87
88	74,63	46,63	74,42	46,96	74,22	47,28	74,01	47,61	88
89	75,48	47,16	75,27	47,49	75,06	47,82	74,85	48,15	89
90	76,32	47,69	76,12	48,03	75,91	48,36	75,69	48,69	90
91	77,17	48,22	76,96	48,56	76,75	48,89	76,53	49,23	91
92	78,02	48,75	77,81	49,09	77,59	49,43	77,38	49,77	92
93	78,87	49,28	78,65	49,63	78,44	49,97	78,22	50,31	93
94	79,72	49,81	79,50	50,16	79,2[illegible]	50,51	79,06	50,85	94
95	80,56	50,34	80,34	50,69	80,12	51,04	79,90	51,39	95
96	81,41	50,87	81,19	51,23	80,97	51,58	80,74	51,93	96
97	82,26	51,40	82,04	51,76	81,81	52,12	81,58	52,47	97
98	83 11	51,93	82,88	52,29	82,65	52,66	82,42	53,02	98
99	83,96	52,46	83,73	52,83	83,50	53,19	83,26	53,56	99
100	84,80	52,99	84,57	53,36	84,34	53,73	84,10	54,10	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	58 Deg.		57¾ Deg.		57½ Deg.		57¼ Deg.		

Dist.	33 Deg. Lat.	33 Deg. Dep.	33¼ Deg. Lat.	33¼ Deg. Dep.	33½ Deg. Lat.	33½ Deg. Dep.	33¾ Deg. Lat.	33¾ Deg. Dep.	Dist.
1	0,84	0,54	0,84	0,55	0,83	0,55	0,83	0,56	1
2	1,68	1,09	1,67	1,10	1,67	1,10	1,66	1,11	2
3	2,52	1,63	2,51	1,64	2,50	1,66	2,49	1,67	3
4	3,35	2,18	3,35	2,19	3,34	2,21	3,33	2,22	4
5	4,19	2,72	4,18	2,74	4,17	2,76	4,16	2,78	5
6	5,03	3,27	5,02	3,29	5,00	3,31	4,99	3,33	6
7	5,87	3,81	5,85	3,84	5,84	3,86	5,82	3,89	7
8	6,71	4,36	6,69	4,39	6,67	4,42	6,65	4,44	8
9	7,55	4,90	7,53	4,93	7,50	4,97	7,48	5,00	9
10	8,39	5,45	8,36	5,48	8,34	5,52	8,31	5,56	10
11	9,23	5,99	9,20	6,03	9,17	6,07	9,15	6,11	11
12	10,06	6,54	10,04	6,58	10,01	6,62	9,98	6,67	12
13	10,90	7,08	10,87	7,13	10,84	7,18	10,81	7,22	13
14	11,74	7,62	11,71	7,68	11,67	7,73	11,64	7,78	14
15	12,58	8,17	12,54	8,22	12,51	8,28	12,47	8,33	15
16	13,42	8,71	13,38	8,77	13,34	8,83	13,30	8,89	16
17	14,26	9,26	14,22	9,32	14,18	9,38	14,13	9,44	17
18	15,10	9,80	15,05	9,87	15,01	9,93	14,97	10,00	18
19	15,93	10,35	15,89	10,42	15,84	10,49	15,80	10,56	19
20	16,77	10,89	16,73	10,97	16,68	11,04	16,63	11,11	20
21	17,61	11,44	17,56	11,51	17,51	11,59	17,46	11,67	21
22	18,45	11,98	18,40	12,06	18,35	12,14	18,29	12,22	22
23	19,29	12,53	19,23	12,61	19,18	12,69	19,12	12,78	23
24	20,13	13,07	20,07	13,16	20,01	13,25	19,96	13,33	24
25	20,97	13,62	20,91	13,71	20,85	13,80	20,79	13,89	25
26	21,81	14,16	21,74	14,26	21,68	14,35	21,62	14,44	26
27	22,64	14,71	22,58	14,80	22,51	14,90	22,45	15,00	27
28	23,48	15,25	23,42	15,35	23,35	15,45	23,28	15,56	28
29	24,32	15,79	24,25	15,90	24,18	16,01	24,11	16,11	29
30	25,16	16,34	25,09	16,45	25,02	16,56	24,94	16,67	30
31	26,00	16,88	25,92	17,00	25,85	17,11	25,78	17,22	31
32	26,84	17,43	26,76	17,55	26,68	17,66	26,61	17,78	32
33	27,68	17,97	27,60	18,09	27,52	18,21	27,44	18,33	33
34	28,51	18,52	28,43	18,64	28,35	18,77	28,27	18,89	34
35	29,35	19,06	29,27	19,19	29,19	19,32	29,10	19,44	35
36	30,19	19,61	30,11	19,74	30,02	19,87	29,93	20,00	36
37	31,03	20,15	30,94	20,29	30,85	20,42	30,76	20,56	37
38	31,87	20,70	31,78	20,84	31,69	20,97	31,60	21,11	38
39	32,71	21,24	32,62	21,38	32,52	21,53	32,43	21,67	39
40	33,55	21,79	33,45	21,93	33,36	22,08	33,26	22,22	40
41	34,39	22,33	34,29	22,48	34,19	22,63	34,09	22,78	41
42	35,22	22,87	35,12	23,03	35,02	23,18	34,92	23,33	42
43	36,06	23,42	35,96	23,58	35,86	23,73	35,75	23,89	43
44	36,90	23,96	36,80	24,12	36,69	24,29	36,58	24,45	44
45	37,74	24,51	37,63	24,67	37,52	24,84	37,42	25,00	45
46	38,58	25,05	38,47	25,22	38,36	25,39	38,25	25,56	46
47	39,42	25,60	39,31	25,77	39,19	25,94	39,08	26,11	47
48	40,26	26,14	40,14	26,32	40,03	26,49	39,91	26,67	48
49	41,09	26,69	40,98	26,87	40,86	27,04	40,74	27,22	49
50	41,93	27,23	41,81	27,41	41,69	27,60	41,57	27,78	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	57 Deg.		56¾ Deg.		56½ Deg.		56¼ Deg.		

Dist.	33 Deg.		33¼ Deg.		33½ Deg.		33¾ Deg.		Dist.
	Lat.	Dep.	Lat	Dep.	Lat.	Dep.	Lat.	Dep.	
51	42,77	27,78	42,65	27,96	42,53	28,15	42,40	28,33	51
52	43,61	28,32	43,49	28,51	43,36	28,70	43,24	28,89	52
53	44,45	28,87	44,32	29,06	44,20	29,25	44,07	29,45	53
54	45,29	29,41	45,16	29,61	45,03	29,80	44,90	30,00	54
55	46,13	29,96	46,00	30,16	45,86	30,36	45,73	30,56	55
56	46,97	30,50	46,83	30,70	46,70	30,91	46,56	31,11	56
57	47,80	31,04	47,67	31,25	47,53	31,46	47,39	31,67	57
58	48,64	31,59	48,50	31,80	48,37	32,01	48,23	32,22	58
59	49,48	32,13	49,34	32,35	49,20	32,56	49,06	32,78	59
60	50,32	32,68	50,18	32,90	50,03	33,12	49,89	33,33	60
61	51,16	33,22	51,01	33,45	50,87	33,67	50,72	33,89	61
62	52,00	33,77	51,85	33,99	51,70	34,22	51,55	34,45	62
63	52,84	34,31	52,69	34,54	52,53	34,77	52,38	35,00	63
64	53,67	34,86	53,52	35,09	53,37	35,32	53,21	35,56	64
65	54,51	35,40	54,36	35,64	54,20	35,88	54,05	36,11	65
66	55,35	35,95	55,19	36,19	55,04	36,43	54,88	36,67	66
67	56,19	36,49	56,03	36,74	55,87	36,98	55,71	37,22	67
68	57,03	37,04	56,87	37,28	56,70	37,53	56,54	37,78	68
69	57,87	37,58	57,70	37,83	57,54	38,08	57,37	38,33	69
70	58,71	38,12	58,54	38,38	58,37	38,64	58,20	38,89	70
71	59,55	38,67	59,38	38,93	59,21	39,19	59,03	39,45	71
72	60,38	39,21	60,21	39,48	60,04	39,74	59,87	40,00	72
73	61,22	39,76	61,05	40,03	60,87	40,29	60,70	40,56	73
74	62,06	40,30	61,89	40,57	61,71	40,84	61,53	41,11	74
75	62,90	40,85	62,72	41,12	62,54	41,40	62,36	41,67	75
76	63,74	41,39	63,56	41,67	63,38	41,95	63,19	42,22	76
77	64,58	41,94	64,39	42,22	64,21	42,50	64,02	42,78	77
78	65,42	42,48	65,23	42,77	65,04	43,05	64,85	43,33	78
79	66,25	43,03	66,07	43,32	65,88	43,60	65,69	43,89	79
80	67,09	43,57	66,90	43,86	66,71	44,15	66,52	44,45	80
81	67,93	44,12	67,74	44,41	67,54	44,71	67,35	45,00	81
82	68,77	44,66	68,58	44,96	68,38	45,26	68,18	45,56	82
83	69,61	45,20	69,41	45,51	69,21	45,81	69,01	46,11	83
84	70,45	45,75	70,25	46,06	70,05	46,36	69,84	46,67	84
85	71,29	46,29	71,08	46,60	70,88	46,91	70,67	47,22	85
86	72,13	46,84	71,92	47,15	71,71	47,47	71,51	47,78	86
87	72,96	47,38	72,76	47,70	72,55	48,02	72,34	48,33	87
88	73,80	47,93	73,59	48,25	73,38	48,57	73,17	48,89	88
89	74,64	48,47	74,43	48,80	74,22	49,12	74,00	49,45	89
90	75,48	49,02	75,27	49,35	75,05	49,67	74,83	50,00	90
91	76,32	49,56	76,10	49,89	75,88	50,23	75,66	50,56	91
92	77,16	50,11	76,94	50,44	76,72	50,78	76,50	51,11	92
93	78,00	50,65	77,77	50,99	77,55	51,33	77,33	51,67	93
94	78,83	51,20	78,61	51,54	78,39	51,88	78,16	52,22	94
95	79,67	51,74	79,45	52,09	79,22	52,43	78,99	52,78	95
96	80,51	52,29	80,28	52,64	80,05	52,99	79,82	53,33	96
97	81,35	52,83	81,12	53,18	80,89	53,54	80,65	53,89	97
98	82,19	53,37	81,96	53,73	81,72	54,09	81,48	54,45	98
99	83,03	53,92	82,79	54,28	82,55	54,64	82,32	55,00	99
100	83,87	54,46	83,63	54,83	83,39	55,19	83,15	55,56	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep	Lat.	Dist.
	57 Deg.		56¾ Deg.		56½ Deg.		56¼ Deg.		

Dist.	34 Deg.		34¼ Deg.		34½ Deg.		34¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,83	0,56	0,83	0,56	0,82	0,57	0,82	0,57	1
2	1,66	1,12	1,65	1,13	1,65	1,13	1,64	1,14	2
3	2,49	1,68	2,48	1,69	2,47	1,70	2,46	1,71	3
4	3,32	2,24	3,31	2,25	3,30	2,27	3,29	2,28	4
5	4,15	2,80	4,13	2,81	4,12	2,83	4,11	2,85	5
6	4,97	3,36	4,96	3,38	4,94	3,40	4,93	3,42	6
7	5,80	3,91	5,79	3,94	5,77	3,96	5,75	3,99	7
8	6,63	4,47	6,61	4,50	6,59	4,53	6,57	4,56	8
9	7,46	5,03	7,44	5,07	7,42	5,10	7,39	5,13	9
10	8,29	5,59	8,27	5,63	8,24	5,66	8,22	5,70	10
11	9,12	6,15	9,09	6,19	9,07	6,23	9,04	6,27	11
12	9,95	6,71	9,92	6,75	9,89	6,80	9,86	6,84	12
13	10,78	7,27	10,75	7,32	10,71	7,36	10,68	7,41	13
14	11,61	7,83	11,57	7,88	11,54	7,93	11,50	7,98	14
15	12,44	8,39	12,40	8,44	12,36	8,50	12,32	8,55	15
16	13,26	8,95	13,23	9,00	13,19	9,06	13,15	9,12	16
17	14,09	9,51	14,05	9,57	14,01	9,63	13,97	9,69	17
18	14,92	10,07	14,88	10,13	14,83	10,20	14,79	10,26	18
19	15,75	10,62	15,71	10,69	15,66	10,76	15,61	10,83	19
20	16,58	11,18	16,53	11,26	16,48	11,33	16,43	11,40	20
21	17,41	11,74	17,36	11,82	17,31	11,89	17,25	11,97	21
22	18,24	12,30	18,18	12,38	18,13	12,46	18,08	12,54	22
23	19,07	12,86	19,01	12,94	18,95	13,03	18,90	13,11	23
24	19,90	13,42	19,84	13,51	19,78	13,59	19,72	13,68	24
25	20,73	13,98	20,66	14,07	20,60	14,16	20,54	14,25	25
26	21,55	14,54	21,49	14,63	21,43	14,73	21,36	14,82	26
27	22,38	15,10	22,32	15,20	22,25	15,29	22,18	15,39	27
28	23,21	15,66	23,14	15,76	23,08	15,86	23,01	15,96	28
29	24,04	16,22	23,97	16,32	23,90	16,43	23,83	16,53	29
30	24,87	16,78	24,80	16,88	24,72	16,99	24,65	17,10	30
31	25,70	17,33	25,62	17,45	25,55	17,56	25,47	17,67	31
32	26,53	17,89	26,45	18,01	26,37	18,12	26,29	18,24	32
33	27,36	18,45	27,28	18,57	27,20	18,69	27,11	18,81	33
34	28,19	19,01	28,10	19,14	28,02	19,26	27,94	19,38	34
35	29,02	19,57	28,93	19,70	28,84	19,82	28,76	19,95	35
36	29,85	20,13	29,76	20,26	29,67	20,39	29,58	20,52	36
37	30,67	20,69	30,58	20,82	30,49	20,96	30,40	21,09	37
38	31,50	21,25	31,41	21,39	31,32	21,52	31,22	21,66	38
39	32,33	21,81	32,24	21,95	32,14	22,09	32,04	22,23	39
40	33,16	22,37	33,06	22,51	32,97	22,66	32,87	22,80	40
41	33,99	22,93	33,89	23,07	33,79	23,22	33,69	23,37	41
42	34,82	23,49	34,72	23,64	34,61	23,79	34,51	23,94	42
43	35,65	24,05	35,54	24,20	35,44	24,36	35,33	24,51	43
44	36,48	24,60	36,37	24,76	36,26	24,92	36,15	25,08	44
45	37,31	25,16	37,20	25,33	37,09	25,49	36,97	25,65	45
46	38,14	25,72	38,02	25,89	37,91	26,05	37,80	26,22	46
47	38,96	26,28	38,85	26,45	38,73	26,62	38,62	26,79	47
48	39,79	26,84	39,68	27,01	39,56	27,19	39,44	27,36	48
49	40,62	27,40	40,50	27,58	40,38	27,75	40,26	27,93	49
50	41,45	27,96	41,33	28,14	41,21	28,32	41,08	28,50	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	56 Deg.		55¾ Deg.		55½ Deg.		55¼ Deg.		

Dist.	34 Deg.		34¼ Deg.		34½ Deg.		34¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	42,28	28,52	42,16	28,70	42,03	28,89	41,90	29,07	51
52	43,11	29,08	42,98	29,27	42,85	29,45	42,73	29,64	52
53	43,94	29,64	43,81	29,83	43,68	30,02	43,55	30,21	53
54	44,77	30,20	44,64	30,39	44,50	30,59	44,37	30,78	54
55	45,60	30,76	45,46	30,95	45,33	31,15	45,19	31,35	55
56	46,43	31,31	46,29	31,52	46,15	31,72	46,01	31,92	56
57	47,26	31,87	47,12	32,08	46,98	32,29	46,83	32,49	57
58	48,08	32,43	47,94	32,64	47,80	32,85	47,66	33,06	58
59	48,91	32,99	48,77	33,21	48,62	33,42	48,48	33,63	59
60	49,74	33,55	49,60	33,77	49,45	33,98	49,30	34,20	60
61	50,57	34,11	50,42	34,33	50,27	34,55	50,12	34,77	61
62	51,40	34,67	51,25	34,89	51,10	35,12	50,94	35,34	62
63	52,23	35,23	52,08	35,46	51,92	35,68	51,76	35,91	63
64	53,06	35,79	52,90	36,02	52,74	36,25	52,59	36,48	64
65	53,89	36,35	53,73	36,58	53,57	36,82	53,41	37,05	65
66	54,72	36,91	54,55	37,15	54,39	37,38	54,23	37,62	66
67	55,55	37,47	55,38	37,71	55,22	37,95	55,05	38,19	67
68	56,37	38,03	56,21	38,27	56,04	38,52	55,87	38,76	68
69	57,20	38,58	57,03	38,83	56,86	39,08	56,69	39,33	69
70	58,03	39,14	57,86	39,40	57,69	39,65	57,52	39,90	70
71	58,86	39,70	58,69	39,96	58,51	40,21	58,34	40,47	71
72	59,69	40,26	59,51	40,52	59,34	40,78	59,16	41,04	72
73	60,52	40,82	60,34	41,08	60,16	41,35	59,98	41,61	73
74	61,35	41,38	61,17	41,65	60,99	41,91	60,80	42,18	74
75	62,18	41,94	61,99	42,21	61,81	42,48	61,62	42,75	75
76	63,01	42,50	62,82	42,77	62,63	43,05	62,45	43,32	76
77	63,84	43,06	63,65	43,34	63,46	43,61	63,27	43,89	77
78	64,66	43,62	64,47	43,90	64,28	44,18	64,09	44,46	78
79	65,49	44,18	65,30	44,46	65,11	44,75	64,91	45,03	79
80	66,32	44,74	66,13	45,02	65,93	45,31	65,73	45,60	80
81	67,15	45,29	66,95	45,59	66,75	45,88	66,55	46,17	81
82	67,98	45,85	67,78	46,15	67,58	46,45	67,37	46,74	82
83	68,81	46,41	68,61	46,71	68,40	47,01	68,20	47,31	83
84	69,64	46,97	69,43	47,28	69,23	47,58	69,02	47,88	84
85	70,47	47,53	70,26	47,84	70,05	48,14	69,84	48,45	85
86	71,30	48,09	71,09	48,40	70,87	48,71	70,66	49,02	86
87	72,13	48,65	71,91	48,96	71,70	49,28	71,48	49,59	87
88	72,96	49,21	72,74	49,53	72,52	49,84	72,30	50,16	88
89	73,78	49,77	73,57	50,09	73,35	50,41	73,13	50,73	89
90	74,61	50,33	74,39	50,65	74,17	50,98	73,95	51,30	90
91	75,44	50,89	75,22	51,22	75,00	51,54	74,77	51,87	91
92	76,27	51,45	76,05	51,78	75,82	52,11	75,59	52,44	92
93	77,10	52,00	76,87	52,34	76,64	52,68	76,41	53,01	93
94	77,93	52,56	77,70	52,90	77,47	53,24	77,23	53,58	94
95	78,76	53,12	78,53	53,47	78,29	53,81	78,06	54,15	95
96	79,59	53,68	79,35	54,03	79,12	54,37	78,88	54,72	96
97	80,42	54,24	80,18	54,59	79,94	54,94	79,70	55,29	97
98	81,25	54,80	81,01	55,15	80,76	55,51	80,52	55,86	98
99	82,07	55,36	81,83	55,72	81,59	56,07	81,34	56,43	99
100	82,90	55,92	82,66	56,28	82,41	56,64	82,16	57,00	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	56 Deg.		55¾ Deg.		55½ Deg.		55¼ Deg.		

Dist.	35 Deg. Lat.	35 Deg. Dep.	35¼ Deg. Lat.	35¼ Deg. Dep.	35½ Deg. Lat.	35½ Deg. Dep.	35¾ Deg. Lat.	35¾ Deg. Dep.	Dist.
1	0,82	0,57	0,82	0,58	0,81	0,58	0,81	0,58	1
2	1,64	1,15	1,63	1,15	1,63	1,16	1,62	1,17	2
3	2,46	1,72	2,45	1,73	2,44	1,74	2,43	1,75	3
4	3,28	2,29	3,27	2,31	3,26	2,32	3,25	2,34	4
5	4,10	2,87	4,08	2,89	4,07	2,90	4,06	2,92	5
6	4,91	3,44	4,90	3,46	4,88	3,48	4,87	3,51	6
7	5,73	4,01	5,72	4,04	5,70	4,06	5,68	4,09	7
8	6,55	4,59	6,53	4,62	6,51	4,65	6,49	4,67	8
9	7,37	5,16	7,35	5,19	7,33	5,23	7,30	5,26	9
10	8,19	5,74	8,17	5,77	8,14	5,81	8,12	5,84	10
11	9,01	6,31	8,98	6,35	8,96	6,39	8,93	6,43	11
12	9,83	6,88	9,80	6,93	9,77	6,97	9,74	7,01	12
13	10,65	7,46	10,62	7,50	10,58	7,55	10,55	7,60	13
14	11,47	8,03	11,43	8,08	11,40	8,13	11,36	8,18	14
15	12,29	8,60	12,25	8,66	12,21	8,71	12,17	8,76	15
16	13,11	9,18	13,07	9,23	13,03	9,29	12,99	9,35	16
17	13,93	9,75	13,88	9,81	13,84	9,87	13,80	9,93	17
18	14,74	10,32	14,70	10,39	14,65	10,45	14,61	10,52	18
19	15,56	10,90	15,52	10,97	15,47	11,03	15,42	11,10	19
20	16,38	11,47	16,33	11,54	16,28	11,61	16,23	11,68	20
21	17,20	12,05	17,15	12,12	17,10	12,19	17,04	12,27	21
22	18,02	12,62	17,97	12,70	17,91	12,78	17,85	12,85	22
23	18,84	13,19	18,78	13,27	18,72	13,36	18,67	13,44	23
24	19,66	13,77	19,60	13,85	19,54	13,94	19,48	14,02	24
25	20,48	14,34	20,42	14,43	20,35	14,52	20,29	14,61	25
26	21,30	14,91	21,23	15,01	21,17	15,10	21,10	15,19	26
27	22,12	15,49	22,05	15,58	21,98	15,68	21,91	15,77	27
28	22,94	16,06	22,87	16,16	22,80	16,26	22,72	16,36	28
29	23,76	16,63	23,68	16,74	23,61	16,84	23,54	16,94	29
30	24,57	17,21	24,50	17,31	24,42	17,42	24,35	17,53	30
31	25,39	17,78	25,32	17,89	25,24	18,00	25,16	18,11	31
32	26,21	18,35	26,13	18,47	26,05	18,58	25,97	18,70	32
33	27,03	18,93	26,95	19,05	26,87	19,16	26,78	19,28	33
34	27,85	19,50	27,77	19,62	27,68	19,74	27,59	19,86	34
35	28,67	20,08	28,58	20,20	28,49	20,32	28,41	20,45	35
36	29,49	20,65	29,40	20,78	29,31	20,91	29,22	21,03	36
37	30,31	21,22	30,22	21,35	30,12	21,49	30,03	21,62	37
38	31,13	21,80	31,03	21,93	30,94	22,07	30,84	22,20	38
39	31,95	22,37	31,85	22,51	31,75	22,65	31,65	22,79	39
40	32,77	22,94	32,67	23,09	32,56	23,23	32,46	23,37	40
41	33,59	23,52	33,48	23,66	33,38	23,81	33,27	23,95	41
42	34,40	24,09	34,30	24,24	34,19	24,39	34,09	24,54	42
43	35,22	24,66	35,12	24,82	35,01	24,97	34,90	25,12	43
44	36,04	25,24	35,93	25,39	35,82	25,55	35,71	25,71	44
45	36,86	25,81	36,75	25,97	36,64	26,13	36,52	26,29	45
46	37,68	26,38	37,57	26,55	37,45	26,71	37,33	26,88	46
47	38,50	26,96	38,38	27,13	38,26	27,29	38,14	27,46	47
48	39,32	27,53	39,20	27,70	39,08	27,87	38,96	28,04	48
49	40,14	28,11	40,02	28,28	39,89	28,45	39,77	28,63	49
50	40,96	28,68	40,83	28,86	40,71	29,04	40,58	29,21	50
Dist.	Dep	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	55 Deg.		54¾ Deg.		54½ Deg.		54¼ Deg.		

Dist.	35 Deg. Lat.	35 Deg. Dep.	35¼ Deg. Lat.	35¼ Deg. Dep.	35½ Deg. Lat.	35½ Deg. Dep.	35¾ Deg. Lat.	35¾ Deg. Dep.	Dist.
51	41,78	29,25	41,65	29,43	41,52	29,62	41,39	29,80	51
52	42,60	29,83	42,47	30,01	42,33	30,20	42,20	30,38	52
53	43,42	30,40	43,28	30,59	43,15	30,78	43,01	30,97	53
54	44,23	30,97	44,10	31,17	43,96	31,36	43,82	31,55	54
55	45,05	31,55	44,92	31,74	44,78	31,94	44,64	32,13	55
56	45,87	32,12	45,73	32,32	45,59	32,52	45,45	32,72	56
57	46,69	32,69	46,55	32,90	46,40	33,10	46,26	33,30	57
58	47,51	33,27	47,37	33,47	47,22	33,68	47,07	33,89	58
59	48,33	33,84	48,18	34,05	48,03	34,26	47,88	34,47	59
60	49,15	34,41	49,00	34,63	48,85	34,84	48,69	35,05	60
61	49,97	34,99	49,82	35,21	49,66	35,42	49,51	35,64	61
62	50,79	35,56	50,63	35,78	50,48	36,00	50,32	36,22	62
63	51,61	36,14	51,45	36,36	51,29	36,58	51,13	36,81	63
64	52,43	36,71	52,27	36,94	52,10	37,16	51,94	37,39	64
65	53,24	37,28	53,08	37,51	52,92	37,75	52,75	37,98	65
66	54,06	37,86	53,90	38,09	53,73	38,33	53,56	38,56	66
67	54,88	38,43	54,71	38,67	54,55	38,91	54,38	39,14	67
68	55,70	39,00	55,53	39,25	55,36	39,49	55,19	39,73	68
69	56,52	39,58	56,35	39,82	56,17	40,07	56,00	40,31	69
70	57,34	40,15	57,16	40,40	56,99	40,65	56,81	40,90	70
71	58,16	40,72	57,98	40,98	57,80	41,23	57,62	41,48	71
72	58,98	41,30	58,80	41,55	58,62	41,81	58,43	42,07	72
73	59,80	41,87	59,61	42,13	59,43	42,39	59,24	42,65	73
74	60,62	42,44	60,43	42,71	60,24	42,97	60,06	43,23	74
75	61,44	43,02	61,25	43,29	61,06	43,55	60,87	43,82	75
76	62,26	43,59	62,06	43,86	61,87	44,13	61,68	44,40	76
77	63,07	44,17	62,88	44,44	62,69	44,71	62,49	44,99	77
78	63,89	44,74	63,70	45,02	63,50	45,29	63,30	45,57	78
79	64,71	45,31	64,51	45,59	64,32	45,88	64,11	46,16	79
80	65,53	45,89	65,33	46,17	65,13	46,46	64,93	46,74	80
81	66,35	46,46	66,15	46,75	65,94	47,04	65,74	47,32	81
82	67,17	47,03	66,96	47,33	66,76	47,62	66,55	47,91	82
83	67,99	47,61	67,78	47,90	67,57	48,20	67,36	48,49	83
84	68,81	48,18	68,60	48,48	68,39	48,78	68,17	49,08	84
85	69,63	48,75	69,41	49,06	69,20	49,36	68,98	49,66	85
86	70,45	49,33	70,23	49,63	70,01	49,94	69,80	50,25	86
87	71,27	49,90	71,05	50,21	70,83	50,52	70,61	50,83	87
88	72,09	50,47	71,86	50,79	71,64	51,10	71,42	51,41	88
89	72,90	51,05	72,68	51,37	72,46	51,68	72,23	52,00	89
90	73,72	51,62	73,50	51,94	73,27	52,26	73,04	52,58	90
91	74,54	52,20	74,31	52,52	74,08	52,84	73,85	53,17	91
92	75,36	52,77	75,13	53,10	74,90	53,42	74,66	53,75	92
93	76,18	53,34	75,95	53,67	75,71	54,01	75,48	54,34	93
94	77,00	53,92	76,76	54,25	76,53	54,59	76,29	54,92	94
95	77,82	54,49	77,58	54,83	77,34	55,17	77,10	55,50	95
96	78,64	55,06	78,40	55,41	78,16	55,75	77,91	56,09	96
97	79,46	55,64	79,21	55,98	78,97	56,33	78,72	56,67	97
98	80,28	56,21	80,03	56,56	79,78	56,91	79,53	57,26	98
99	81,10	56,78	80,85	57,14	80,60	57,49	80,35	57,84	99
100	81,92	57,36	81,66	57,71	81,41	58,07	81,16	58,42	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	55 Deg.		54¾ Deg.		54½ Deg.		54¼ Deg.		

Dist.	36 Deg. Lat.	36 Deg. Dep.	36¼ Deg. Lat.	36¼ Deg. Dep.	36½ Deg. Lat.	36½ Deg. Dep.	36¾ Deg. Lat.	36¾ Deg. Dep.	Dist.
1	0,81	0,59	0,81	0,59	0,80	0,59	0,80	0,60	1
2	1,62	1,18	1,61	1,18	1,61	1,19	1,60	1,20	2
3	2,43	1,76	2,42	1,77	2,41	1,78	2,40	1,79	3
4	3,24	2,35	3,23	2,37	3,22	2,38	3,20	2,39	4
5	4,05	2,94	4,03	2,96	4,02	2,97	4,01	2,99	5
6	4,85	3,53	4,84	3,55	4,82	3,57	4,81	3,59	6
7	5,66	4,11	5,65	4,14	5,63	4,16	5,61	4,19	7
8	6,47	4,70	6,45	4,73	6,43	4,76	6,41	4,79	8
9	7,28	5,29	7,26	5,32	7,23	5,35	7,21	5,38	9
10	8,09	5,88	8,06	5,91	8,04	5,95	8,01	5,98	10
11	8,90	6,47	8,87	6,50	8,84	6,54	8,81	6,58	11
12	9,71	7,05	9,68	7,10	9,65	7,14	9,61	7,18	12
13	10,52	7,64	10,48	7,69	10,45	7,73	10,42	7,78	13
14	11,33	8,23	11,29	8,28	11,25	8,33	11,22	8,38	14
15	12,14	8,82	12,10	8,87	12,06	8,92	12,02	8,97	15
16	12,94	9,40	12,90	9,46	12,86	9,52	12,82	9,57	16
17	13,75	9,99	13,71	10,05	13,67	10,11	13,62	10,17	17
18	14,56	10,58	14,52	10,64	14,47	10,71	14,42	10,77	18
19	15,37	11,17	15,32	11,23	15,27	11,30	15,22	11,37	19
20	16,18	11,76	16,13	11,83	16,08	11,90	16,03	11,97	20
21	16,99	12,34	16,94	12,42	16,88	12,49	16,83	12,56	21
22	17,80	12,93	17,74	13,01	17,68	13,09	17,63	13,16	22
23	18,61	13,52	18,55	13,60	18,49	13,68	18,43	13,76	23
24	19,42	14,11	19,35	14,19	19,29	14,28	19,23	14,36	24
25	20,23	14,69	20,16	14,78	20,10	14,87	20,03	14,96	25
26	21,03	15,28	20,97	15,37	20,90	15,47	20,83	15,56	26
27	21,84	15,87	21,77	15,97	21,70	16,06	21,63	16,15	27
28	22,65	16,46	22,58	16,56	22,51	16,65	22,44	16,75	28
29	23,46	17,05	23,39	17,15	23,31	17,25	23,24	17,35	29
30	24,27	17,63	24,19	17,74	24,12	17,84	24,04	17,95	30
31	25,08	18,22	25,00	18,33	24,92	18,44	24,84	18,55	31
32	25,89	18,81	25,81	18,92	25,72	19,03	25,64	19,15	32
33	26,70	19,40	26,61	19,51	26,53	19,63	26,44	19,74	33
34	27,51	19,98	27,42	20,10	27,33	20,22	27,24	20,34	34
35	28,32	20,57	28,23	20,70	28,13	20,82	28,04	20,94	35
36	29,12	21,16	29,03	21,29	28,94	21,41	28,85	21,54	36
37	29,93	21,75	29,84	21,88	29,74	22,01	29,65	22,14	37
38	30,74	22,34	30,64	22,47	30,55	22,60	30,45	22,74	38
39	31,55	22,92	31,45	23,06	31,35	23,20	31,25	23,33	39
40	32,36	23,51	32,26	23,65	32,15	23,79	32,05	23,93	40
41	33,17	24,10	33,06	24,24	32,96	24,39	32,85	24,53	41
42	33,98	24,69	33,87	24,83	33,76	24,98	33,65	25,13	42
43	34,79	25,27	34,68	25,43	34,57	25,58	34,45	25,73	43
44	35,60	25,86	35,48	26,02	35,37	26,17	35,26	26,33	44
45	36,41	26,45	36,29	26,61	36,17	26,77	36,06	26,92	45
46	37,21	27,04	37,10	27,20	36,98	27,36	36,86	27,52	46
47	38,02	27,63	37,90	27,79	37,78	27,96	37,66	28,12	47
48	38,83	28,21	38,71	28,38	38,59	28,55	38,46	28,72	48
49	39,64	28,80	39,52	28,97	39,39	29,15	39,26	29,32	49
50	40,45	29,39	40,32	29,57	40,19	29,74	40,06	29,92	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	54 Deg.		53¾ Deg.		53½ Deg.		53¼ Deg.		

Dist.	36 Deg. Lat.	36 Deg. Dep.	36¼ Deg. Lat.	36¼ Deg. Dep.	36½ Deg. Lat.	36½ Deg. Dep.	36¾ Deg. Lat.	36¾ Deg. Dep.	Dist.
51	41,26	29,98	41,13	30,16	41,00	30,34	40,86	30,51	51
52	42,07	30,56	41,94	30,75	41,80	30,93	41,67	31,11	52
53	42,88	31,15	42,74	31,34	42,60	31,53	42,47	31,71	53
54	43,69	31,74	43,55	31,93	43,41	32,12	43,27	32,31	54
55	44,50	32,33	44,35	32,52	44,21	32,72	44,07	32,91	55
56	45,30	32,92	45,16	33,11	45,02	33,31	44,87	33,51	56
57	46,11	33,50	45,97	33,70	45,82	33,90	45,67	34,10	57
58	46,92	34,09	46,77	34,30	46,62	34,50	46,47	34,70	58
59	47,73	34,68	47,58	34,89	47,43	35,09	47,27	35,30	59
60	48,54	35,27	48,39	35,48	48,23	35,69	48,08	35,90	60
61	49,35	35,85	49,19	36,07	49,04	36,28	48,88	36,50	61
62	50,16	36,44	50,00	36,66	49,84	36,88	49,68	37,10	62
63	50,97	37,03	50,81	37,25	50,64	37,47	50,48	37,69	63
64	51,78	37,62	51,61	37,84	51,45	38,07	51,28	38,29	64
65	52,59	38,21	52,42	38,44	52,25	38,66	52,08	38,89	65
66	53,40	38,79	53,23	39,03	53,05	39,26	52,88	39,49	66
67	54,20	39,38	54,03	39,62	53,86	39,85	53,68	40,09	67
68	55,01	39,97	54,84	40,21	54,66	40,45	54,49	40,69	68
69	55,82	40,56	55,64	40,80	55,47	41,04	55,29	41,28	69
70	56,63	41,14	56,45	41,39	56,27	41,64	56,09	41,88	70
71	57,44	41,73	57,26	41,98	57,07	42,23	56,89	42,48	71
72	58,25	42,32	58,06	42,57	57,88	42,83	57,69	43,08	72
73	59,06	42,91	58,87	43,17	58,68	43,42	58,49	43,68	73
74	59,87	43,50	59,68	43,76	59,49	44,02	59,29	44,28	74
75	60,68	44,08	60,48	44,35	60,29	44,61	60,09	44,87	75
76	61,49	44,67	61,29	44,94	61,09	45,21	60,90	45,47	76
77	62,29	45,26	62,10	45,53	61,90	45,80	61,70	46,07	77
78	63,10	45,85	62,90	46,12	62,70	46,49	62,50	46,67	78
79	63,91	46,43	63,71	46,71	63,50	46,99	63,30	47,27	79
80	64,72	47,02	64,52	47,30	64,31	47,59	64,10	47,87	80
81	65,53	47,61	65,32	47,90	65,11	48,18	64,90	48,46	81
82	66,34	48,20	66,13	48,49	65,92	48,78	65,70	49,06	82
83	67,15	48,79	66,93	49,08	66,72	49,37	66,50	49,66	83
84	67,96	49,37	67,74	49,67	67,52	49,97	67,31	50,26	84
85	68,77	49,96	68,55	50,26	68,33	50,56	68,11	50,86	85
86	69,58	50,55	69,35	50,85	69,13	51,15	68,91	51,46	86
87	70,38	51,14	70,16	51,44	69,94	51,75	69,71	52,05	87
88	71,19	51,73	70,97	52,04	70,74	52,34	70,51	52,65	88
89	72,00	52,31	71,77	52,63	71,54	52,94	71,31	53,25	89
90	72,81	52,90	72,58	53,22	72,35	53,53	72,11	53,85	90
91	73,62	53,49	73,39	53,81	73,15	54,13	72,91	54,45	91
92	74,43	54,08	74,19	54,40	73,95	54,72	73,72	55,05	92
93	75,24	54,66	75,00	54,99	74,76	55,32	74,52	55,64	93
94	76,05	55,25	75,81	55,58	75,56	55,91	75,32	56,24	94
95	76,86	55,84	76,61	56,17	76,37	56,51	76,12	56,84	95
96	77,67	56,43	77,42	56,77	77,17	57,10	76,92	57,44	96
97	78,47	57,02	78,23	57,36	77,97	57,70	77,72	58,04	97
98	79,28	57,60	79,03	57,95	78,78	58,29	78,52	58,64	98
99	80,09	58,19	79,84	58,54	79,58	58,89	79,32	59,23	99
100	80,90	58,78	80,64	59,13	80,39	59,48	80,13	59,83	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	54 Deg.		53¾ Deg.		53½ Deg.		53¼ Deg.		

Dist.	37 Deg. Lat.	37 Deg. Dep.	37¼ Deg. Lat.	37¼ Deg. Dep.	37½ Deg. Lat.	37½ Deg. Dep.	37¾ Deg. Lat.	37¾ Deg. Dep.	Dist.
1	0,80	0,60	0,80	0,61	0,79	0,61	0,79	0,61	1
2	1,60	1,20	1,59	1,21	1,59	1,22	1,58	1,22	2
3	2,40	1,81	2,39	1,82	2,38	1,83	2,37	1,84	3
4	3,19	2,41	3,18	2,42	3,17	2,43	3,16	2,45	4
5	3,99	3,01	3,98	3,03	3,97	3,04	3,95	3,06	5
6	4,79	3,61	4,78	3,63	4,76	3,65	4,74	3,67	6
7	5,59	4,21	5,57	4,24	5,55	4,26	5,53	4,29	7
8	6,39	4,81	6,37	4,84	6,35	4,87	6,33	4,90	8
9	7,19	5,42	7,16	5,45	7,14	5,48	7,12	5,51	9
10	7,99	6,02	7,96	6,05	7,93	6,09	7,91	6,12	10
11	8,78	6,62	8,76	6,66	8,73	6,70	8,70	6,73	11
12	9,58	7,22	9,55	7,26	9,52	7,31	9,49	7,35	12
13	10,38	7,82	10,35	7,87	10,31	7,91	10,28	7,96	13
14	11,18	8,43	11,14	8,47	11,11	8,52	11,07	8,57	14
15	11,98	9,03	11,94	9,08	11,90	9,13	11,86	9,18	15
16	12,78	9,63	12,74	9,68	12,69	9,74	12,65	9,80	16
17	13,58	10,23	13,53	10,29	13,49	10,35	13,44	10,41	17
18	14,38	10,83	14,33	10,90	14,28	10,96	14,23	11,02	18
19	15,17	11,43	15,12	11,50	15,07	11,57	15,02	11,63	19
20	15,97	12,04	15,92	12,11	15,87	12,18	15,81	12,24	20
21	16,77	12,64	16,72	12,71	16,66	12,78	16,60	12,86	21
22	17,57	13,24	17,51	13,32	17,45	13,39	17,40	13,47	22
23	18,37	13,84	18,31	13,92	18,25	14,00	18,19	14,08	23
24	19,17	14,44	19,10	14,53	19,04	14,61	18,98	14,69	24
25	19,97	15,05	19,90	15,13	19,83	15,22	19,77	15,31	25
26	20,76	15,65	20,70	15,74	20,63	15,83	20,56	15,92	26
27	21,56	16,25	21,49	16,34	21,42	16,44	21,35	16,53	27
28	22,36	16,85	22,29	16,95	22,21	17,05	22,14	17,14	28
29	23,16	17,45	23,08	17,55	23,01	17,65	22,93	17,75	29
30	23,96	18,05	23,88	18,16	23,80	18,26	23,72	18,37	30
31	24,76	18,66	24,68	18,76	24,59	18,87	24,51	18,98	31
32	25,56	19,26	25,47	19,37	25,39	19,48	25,30	19,59	32
33	26,35	19,86	26,27	19,97	26,18	20,09	26,09	20,20	33
34	27,15	20,46	27,06	20,58	26,97	20,70	26,88	20,82	34
35	27,95	21,06	27,86	21,19	27,77	21,31	27,67	21,43	35
36	28,75	21,67	28,66	21,79	28,56	21,92	28,46	22,04	36
37	29,55	22,27	29,45	22,40	29,35	22,52	29,26	22,65	37
38	30,35	22,87	30,25	23,00	30,15	23,13	30,05	23,26	38
39	31,15	23,47	31,04	23,61	30,94	23,74	30,84	23,88	39
40	31,95	24,07	31,84	24,21	31,73	24,35	31,63	24,49	40
41	32,74	24,67	32,64	24,82	32,53	24,96	32,42	25,10	41
42	33,54	25,28	33,43	25,42	33,32	25,57	33,21	25,71	42
43	34,34	25,88	34,23	26,03	34,11	26,18	34,00	26,33	43
44	35,14	26,48	35,02	26,63	34,91	26,79	34,79	26,94	44
45	35,94	27,08	35,82	27,24	35,70	27,39	35,58	27,55	45
46	36,74	27,68	36,62	27,84	36,49	28,00	36,37	28,16	46
47	37,54	28,29	37,41	28,45	37,29	28,61	37,16	28,77	47
48	38,33	28,89	38,21	29,05	38,08	29,22	37,95	29,39	48
49	39,13	29,49	39,00	29,66	38,87	29,83	38,74	30,00	49
50	39,93	30,09	39,80	30,26	39,67	30,44	39,53	30,61	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	53 Deg.		52¾ Deg.		52½ Deg.		52¼ Deg.		

Dist.	37 Deg.		37¼ Deg.		37½ Deg.		37¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	40,73	30,69	40,60	30,87	40,46	31,05	40,33	31,22	51
52	41,53	31,29	41,39	31,48	41,25	31,66	41,12	31,84	52
53	42,33	31,90	42,19	32,08	42,05	32,26	41,91	32,45	53
54	43,13	32,50	42,98	32,69	42,84	32,87	42,70	33,06	54
55	43,92	33,10	43,78	33,29	43,63	33,48	43,49	33,67	55
56	44,72	33,70	44,58	33,90	44,43	34,09	44,28	34,28	56
57	45,52	34,30	45,37	34,50	45,22	34,70	45,07	34,90	57
58	46,32	34,91	46,17	35,11	46,01	35,31	45,86	35,51	58
59	47,12	35,51	46,96	35,71	46,81	35,92	46,65	36,12	59
60	47,92	36,11	47,76	36,32	47,60	36,53	47,44	36,73	60
61	48,72	36,71	48,56	36,92	48,39	37,13	48,23	37,35	61
62	49,52	37,31	49,35	37,53	49,19	37,74	49,02	37,96	62
63	50,31	37,91	50,15	38,13	49,98	38,35	49,81	38,57	63
64	51,11	38,52	50,94	38,74	50,77	38,96	50,60	39,18	64
65	51,91	39,12	51,74	39,34	51,57	39,57	51,39	39,79	65
66	52,71	39,72	52,54	39,95	52,36	40,18	52,19	40,41	66
67	53,51	40,32	53,33	40,55	53,15	40,79	52,98	41,02	67
68	54,31	40,92	54,13	41,16	53,95	41,40	53,77	41,63	68
69	55,11	41,53	54,92	41,77	54,74	42,00	54,56	42,24	69
70	55,90	42,13	55,72	42,37	55,53	42,61	55,35	42,86	70
71	56,70	42,73	56,52	42,98	56,33	43,22	56,14	43,47	71
72	57,50	43,33	57,31	43,58	57,12	43,83	56,93	44,08	72
73	58,30	43,93	58,11	44,19	57,91	44,44	57,72	44,69	73
74	59,10	44,53	58,90	44,79	58,71	45,05	58,51	45,30	74
75	59,90	45,14	59,70	45,40	59,50	45,66	59,30	45,92	75
76	60,70	45,74	60,50	46,00	60,29	46,27	60,09	46,53	76
77	61,49	46,34	61,29	46,61	61,09	46,87	60,88	47,14	77
78	62,29	46,94	62,09	47,21	61,88	47,48	61,67	47,75	78
79	63,09	47,54	62,88	47,82	62,67	48,09	62,46	48,37	79
80	63,89	48,15	63,68	48,42	63,47	48,70	63,26	48,98	80
81	64,69	48,75	64,48	49,03	64,26	49,31	64,05	49,59	81
82	65,49	49,35	65,27	49,63	65,05	49,92	64,84	50,20	82
83	66,29	49,95	66,07	50,24	65,85	50,53	65,63	50,81	83
84	67,09	50,55	66,86	50,84	66,64	51,14	66,42	51,43	84
85	67,88	51,15	67,66	51,45	67,43	51,74	67,21	52,04	85
86	68,68	51,76	68,46	52,06	68,23	52,35	68,00	52,65	86
87	69,48	52,36	69,25	52,66	69,02	52,96	68,79	53,26	87
88	70,28	52,96	70,05	53,27	69,82	53,57	69,58	53,88	88
89	71,08	53,56	70,84	53,87	70,61	54,18	70,37	54,49	89
90	71,88	54,16	71,64	54,48	71,40	54,79	71,16	55,10	90
91	72,68	54,77	72,44	55,08	72,20	55,40	71,95	55,71	91
92	73,47	55,37	73,23	55,69	72,99	56,01	72,74	56,32	92
93	74,27	55,97	74,03	56,29	73,78	56,61	73,53	56,94	93
94	75,07	56,57	74,82	56,90	74,58	57,22	74,32	57,55	94
95	75,87	57,17	75,62	57,50	75,37	57,83	75,12	58,16	95
96	76,67	57,77	76,42	58,11	76,16	58,44	75,91	58,77	96
97	77,47	58,38	77,21	58,71	76,96	59,05	76,70	59,39	97
98	78,27	58,98	78,01	59,32	77,75	59,66	77,49	60,00	98
99	79,06	59,58	78,80	59,92	78,54	60,27	78,28	60,61	99
100	79,86	60,18	79,60	60,53	79,34	60,88	79,07	61,22	100
	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	
Dist.	53 Deg.		52¾ Deg.		52½ Deg.		52¼ Deg.		Dist.

Dist.	38 Deg. Lat.	38 Deg. Dep.	38¼ Deg. Lat.	38¼ Deg. Dep.	38½ Deg. Lat.	38½ Deg. Dep.	38¾ Deg. Lat.	38¾ Deg. Dep.	Dist.
1	0,79	0,62	0,79	0,62	0,78	0,62	0,78	0,63	1
2	1,58	1,23	1,57	1,24	1,57	1,24	1,56	1,25	2
3	2,36	1,85	2,36	1,86	2,35	1,87	2,34	1,88	3
4	3,15	2,46	3,14	2,48	3,13	2,49	3,12	2,50	4
5	3,94	3,08	3,93	3,10	3,91	3,11	3,90	3,13	5
6	4,73	3,69	4,71	3,71	4,70	3,74	4,68	3,76	6
7	5,52	4,31	5,50	4,33	5,48	4,36	5,46	4,38	7
8	6,30	4,93	6,28	4,95	6,26	4,98	6,24	5,01	8
9	7,09	5,54	7,07	5,57	7,04	5,60	7,02	5,63	9
10	7,88	6,16	7,85	6,19	7,83	6,23	7,80	6,26	10
11	8,67	6,77	8,64	6,81	8,61	6,85	8,58	6,89	11
12	9,46	7,39	9,42	7,43	9,39	7,47	9,36	7,51	12
13	10,24	8,00	10,21	8,05	10,17	8,09	10,14	8,14	13
14	11,03	8,62	10,99	8,67	10,96	8,72	10,92	8,76	14
15	11,82	9,23	11,78	9,29	11,74	9,34	11,70	9,39	15
16	12,61	9,85	12,57	9,91	12,52	9,96	12,48	10,01	16
17	13,40	10,47	13,35	10,52	13,30	10,58	13,26	10,64	17
18	14,18	11,08	14,14	11,14	14,09	11,21	14,04	11,27	18
19	14,97	11,70	14,92	11,76	14,87	11,83	14,82	11,89	19
20	15,76	12,31	15,71	12,38	15,65	12,45	15,60	12,52	20
21	16,55	12,93	16,49	13,00	16,43	13,07	16,38	13,14	21
22	17,34	13,54	17,28	13,62	17,22	13,70	17,16	13,77	22
23	18,12	14,16	18,06	14,24	18,00	14,32	17,94	14,40	23
24	18,91	14,78	18,85	14,86	18,78	14,94	18,72	15,02	24
25	19,70	15,39	19,63	15,48	19,57	15,56	19,50	15,65	25
26	20,49	16,01	20,42	16,10	20,35	16,19	20,28	16,27	26
27	21,28	16,62	21,20	16,72	21,13	16,81	21,06	16,90	27
28	22,06	17,24	21,99	17,33	21,91	17,43	21,84	17,53	28
29	22,85	17,85	22,77	17,95	22,70	18,05	22,62	18,15	29
30	23,64	18,47	23,56	18,57	23,48	18,68	23,40	18,78	30
31	24,43	19,09	24,34	19,19	24,26	19,30	24,18	19,40	31
32	25,22	19,70	25,13	19,81	25,04	19,92	24,96	20,03	32
33	26,00	20,32	25,92	20,43	25,83	20,54	25,74	20,66	33
34	26,79	20,93	26,70	21,05	26,61	21,17	26,52	21,28	34
35	27,58	21,55	27,49	21,67	27,39	21,79	27,30	21,91	35
36	28,37	22,16	28,27	22,29	28,17	22,41	28,08	22,53	36
37	29 16	22,78	29,06	22,91	28,96	23,03	28,86	23,16	37
38	29,94	23,40	29,84	23,53	29,74	23,66	29,64	23,79	38
39	30,73	24,01	30,63	24,14	30,52	24,28	30,42	24,41	39
40	31,52	24,63	31,41	24,76	31,30	24,90	31,20	25,04	40
41	32,31	25,24	32,20	25,38	32,09	25,52	31,98	25,66	41
42	33,10	25,86	32,98	26,00	32,87	26,15	32,76	26,29	42
43	33,88	26,47	33,77	26,62	33,65	26,77	33,53	26,91	43
44	34,67	27,09	34,55	27,24	34,43	27,39	34,31	27,54	44
45	35,46	27,70	35,34	27,86	35,22	28,01	35,09	28,17	45
46	36,25	28,32	36,12	28,48	36,00	28,64	35,87	28,79	46
47	37,04	28,94	36,91	29,10	36,78	29,26	36,65	29,42	47
48	37,82	29,55	37,70	29,72	37,57	29,88	37,43	30,04	48
49	38,61	30,17	38,48	30,34	38,35	30,50	38,21	30,67	49
50	39,40	30,78	39,27	30,95	39,13	31,13	38,99	31,30	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	52 Deg.		51¾ Deg.		51½ Deg.		51¼ Deg.		

Dist.	38 Deg. Lat.	38 Deg. Dep.	38¼ Deg. Lat	38¼ Deg. Dep.	38½ Deg. Lat.	38½ Deg. Dep.	38¾ Deg. Lat.	38¾ Deg. Dep.	Dist.
51	40,19	31,40	40,05	31,57	39,91	31,75	39,77	31,92	51
52	40,98	32,01	40,84	32,19	40,70	32,37	40,55	32,55	52
53	41,76	32,63	41,62	32,81	41,48	32,99	41,33	33,17	53
54	42,55	33,25	42,41	33,43	42,26	33,62	42,11	33,80	54
55	43,34	33,86	43,19	34,05	43,04	34,24	42,89	34,43	55
56	44,13	34,48	43,98	34,67	43,83	34,86	43,67	35,05	56
57	44,92	35,09	44,76	35,29	44,61	35,48	44,45	35,68	57
58	45,70	35,71	45,55	35,91	45,39	36,11	45,23	36,30	58
59	46,49	36,32	46,33	36,53	46,17	36,73	46,01	36,93	59
60	47,28	36,94	47,12	37,15	46,96	37,35	46,79	37,56	60
61	48,07	37,56	47,90	37,76	47,74	37,97	47,57	38,18	61
62	48,86	38,17	48,69	38,38	48,52	38,60	48,35	38,81	62
63	49,64	38,79	49,47	39,00	49,30	39,22	49,13	39,43	63
64	50,43	39,40	50,26	39,62	50,09	39,84	49,91	40,06	64
65	51,22	40,02	51,05	40,24	50,87	40,46	50,69	40,68	65
66	52,01	40,63	51,83	40,86	51,65	41,09	51,47	41,31	66
67	52,80	41,25	52,62	41,48	52,43	41,71	52,25	41,94	67
68	53,58	41,86	53,40	42,10	53,22	42,33	53,03	42,56	68
69	54,37	42,48	54,19	42,72	54,00	42,95	53,81	43,19	69
70	55,16	43,10	54,97	43,34	54,78	43,58	54,59	43,81	70
71	55,95	43,71	55,76	43,96	55,57	44,20	55,37	44,44	71
72	56,74	44,33	56,54	44,57	56,35	44,82	56,15	45,07	72
73	57,52	44,94	57,33	45,19	57,13	45,44	56,93	45,69	73
74	58,31	45,56	58,11	45,81	57,91	46,07	57,71	46,32	74
75	59,10	46,17	58,90	46,43	58,70	46,69	58,49	46,94	75
76	59,89	46,79	59,68	47,05	59,48	47,31	59,27	47,57	76
77	60,68	47,41	60,47	47,67	60,26	47,93	60,05	48,20	77
78	61,46	48,02	61,25	48,29	61,04	48,56	60,83	48,82	78
79	62,25	48,64	62,04	48,91	61,83	49,18	61,61	49,45	79
80	63,04	49,25	62,83	49,53	62,61	49,80	62,39	50,07	80
81	63,83	49,87	63,61	50,15	63,39	50,42	63,17	50,70	81
82	64,62	50,48	64,40	50,77	64,17	51,05	63,95	51,33	82
83	65,40	51,10	65,18	51,38	64,96	51,67	64,73	51,95	83
84	66,19	51,72	65,97	52,00	65,74	52,29	65,51	52,58	84
85	66,98	52,33	66,75	52,62	66,52	52,91	66,29	53,20	85
86	67,77	52,95	67,54	53,24	67,30	53,54	67,07	53,83	86
87	68,56	53,56	68,32	53,86	68,09	54,16	67,85	54,46	87
88	69,34	54,18	69,11	54,48	68,87	54,78	68,63	55,08	88
89	70,13	54,79	69,89	55,10	69,65	55,40	69,41	55,71	89
90	70,92	55,41	70,68	55,72	70,43	56,03	70,19	56,33	90
91	71,71	56,03	71,46	56,34	71,22	56,65	70,97	56,96	91
92	72,50	56,64	72,25	56,96	72,00	57,27	71,75	57,58	92
93	73,28	57,26	73,03	57,58	72,78	57,89	72,53	58,21	93
94	74,07	57,87	73,82	58,19	73,57	58,52	73,31	58,84	94
95	74,86	58,49	74,61	58,81	74,35	59,14	74,09	59,46	95
96	75,65	59,10	75,39	59,43	75,13	59,76	74,87	60,09	96
97	76,44	59,72	76,18	60,05	75,91	60,38	75,65	60,71	97
98	77,22	60,33	76,96	60,67	76,70	61,01	76,43	61,34	98
99	78,01	60,95	77,75	61,29	77,48	61,63	77,21	61,97	99
100	78,80	61,57	78,53	61,91	78,26	62,25	77,99	62,59	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat	Dist.
	52 Deg.		51¾ Deg.		51½ Deg.		51¼ Deg.		

Dist.	39 Deg.		39¼ Deg.		39½ Deg.		39¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
1	0,78	0,63	0,77	0,63	0,77	0,64	0,77	0,64	1
2	1,55	1,26	1,55	1,27	1,54	1,27	1,54	1,28	2
3	2,33	1,89	2,32	1,90	2,31	1,91	2,31	1,92	3
4	3,11	2,52	3,10	2,53	3,09	2,54	3,08	2,56	4
5	3,89	3,15	3,87	3,16	3,86	3,18	3,84	3,20	5
6	4,66	3,78	4,65	3,80	4,63	3,82	4,61	3,84	6
7	5,44	4,41	5,42	4,43	5,40	4,45	5,38	4,48	7
8	6,22	5,03	6,20	5,06	6,17	5,09	6,15	5,12	8
9	6,99	5,66	6,97	5,69	6,94	5,72	6,92	5,75	9
10	7,77	6,29	7,74	6,33	7,72	6,36	7,69	6,39	10
11	8,55	6,92	8,52	6,96	8,49	7,00	8,46	7,03	11
12	9,33	7,55	9,29	7,59	9,26	7,63	9,23	7,67	12
13	10,10	8,18	10,07	8,23	10,03	8,27	9,99	8,31	13
14	10,88	8,81	10,84	8,86	10,80	8,91	10,76	8,95	14
15	11,66	9,44	11,62	9,49	11,57	9,54	11,53	9,59	15
16	12,43	10,07	12,39	10,12	12,35	10,18	12,30	10,23	16
17	13,21	10,70	13,16	10,76	13,12	10,81	13,07	10,87	17
18	13,99	11,33	13,94	11,39	13,89	11,45	13,84	11,51	18
19	14,77	11,96	14,71	12,02	14,66	12,09	14,61	12,15	19
20	15,54	12,59	15,49	12,65	15,43	12,72	15,38	12,79	20
21	16,32	13,22	16,26	13,29	16,20	13,36	16,15	13,43	21
22	17,10	13,84	17,04	13,92	16,98	13,99	16,91	14,07	22
23	17,87	14,47	17,81	14,55	17,75	14,63	17,68	14,71	23
24	18,65	15,10	18,59	15,18	18,52	15,27	18,45	15,35	24
25	19,43	15,73	19,36	15,82	19,29	15,90	19,22	15,99	25
26	20,21	16,36	20,13	16,45	20,06	16,54	19,99	16,63	26
27	20,98	16,99	20,91	17,08	20,83	17,17	20,76	17,26	27
28	21,76	17,62	21,68	17,72	21,61	17,81	21,53	17,90	28
29	22,54	18,25	22,46	18,35	22,38	18,45	22,30	18,54	29
30	23,31	18,88	23,23	18,98	23,15	19,08	23,07	19,18	30
31	24,09	19 51	24,01	19,61	23,92	19,72	23,83	19,82	31
32	24,87	20,14	24,78	20,25	24,69	20,35	24,60	20,46	32
33	25,65	20,77	25,55	20,88	25,46	20,99	25,37	21,10	33
34	26,42	21,40	26,33	21,51	26,24	21,63	26,14	21,74	34
35	27,20	22,03	27,10	22,14	27,01	22,26	26,91	22,38	35
36	27,98	22,66	27,88	22,78	27,78	22,90	27,68	23,02	36
37	28,75	23,28	28,65	23,41	28,55	23,53	28,45	23,66	37
38	29,53	23,91	29,43	24,04	29.32	24,17	29,22	24,30	38
39	30,31	24,54	30,20	24,68	30,09	24,81	29,98	24,94	39
40	31,09	25,17	30,98	25,31	30,86	25,44	30,75	25,58	40
41	31,86	25,80	31,75	25,94	31,64	26,08	31,52	26,22	41
42	32,64	26,43	32,52	26,57	32,41	26,72	32,29	26,86	42
43	33,42	27,06	33,30	27,21	33,18	27,35	33,06	27,50	43
44	34,19	27,69	34,07	27,84	33,95	27,99	33,83	28,14	44
45	34,97	28,32	34,85	28,47	34,72	28,62	34,60	28,77	45
46	35,75	28,95	35,62	29,10	35,49	29,26	35,37	29,41	46
47	36,53	29,58	36,40	29,74	36,27	29,90	36,14	30,05	47
48	37,30	30,21	37,17	30,37	37,04	30,53	36,90	30,69	48
49	38,08	30,84	37,95	31,00	37,81	31,17	37,67	31,33	49
50	38,86	31,47	38,72	31,64	38,58	31,80	38,44	31,97	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	51 Deg.		50¾ Deg.		50½ Deg.		50¼ Deg.		

Dist.	39 Deg.		39¼ Deg.		39½ Deg.		39¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	39,63	32,10	39,49	32,27	39,35	32,44	39,21	32,61	51
52	40,41	32,72	40,27	32,90	40,12	33,08	39,98	33,25	52
53	41,19	33,35	41,04	33,53	40,90	33,71	40,75	33,89	53
54	41,97	33,98	41,82	34,17	41,67	34,35	41,52	34,53	54
55	42,74	34,61	42,59	34,80	42,44	34,98	42,29	35,17	55
56	43,52	35,24	43,37	35,43	43,21	35,62	43,06	35,81	56
57	44,30	35,87	44,14	36,06	43,98	36,26	43,82	36,45	57
58	45,07	36,50	44,91	36,70	44,75	36,89	44,59	37,09	58
59	45,85	37,13	45,69	37,33	45,53	37,53	45,36	37,73	59
60	46,63	37,76	46,46	37,96	46,30	38,16	46,13	38,37	60
61	47,41	38,39	47,24	38,60	47,07	38,80	46,90	39,01	61
62	48,18	39,02	48,01	39,23	47,84	39,44	47,67	39,65	62
63	48,96	39,65	48,79	39,86	48,61	40,07	48,44	40,28	63
64	49,74	40,28	49,56	40,49	49,38	40,71	49,21	40,92	64
65	50,51	40,91	50,34	41,13	50,16	41,35	49,97	41,56	65
66	51,29	41,54	51,11	41,76	50,93	41,98	50,74	42,20	66
67	52,07	42,16	51,88	42,39	51,70	42,62	51,51	42,84	67
68	52,85	42,79	52,66	43,02	52,47	43,25	52,28	43,48	68
69	53,52	43,42	53,43	43,66	53,24	43,89	53,05	44,12	69
70	54,40	44,05	54,21	44,29	54,01	44,53	53,82	44,76	70
71	55,18	44,68	54,98	44,92	54,79	45,16	54,59	45,40	71
72	55,95	45,31	55,76	45,55	55,56	45,80	55,36	46,04	72
73	56,73	45,94	56,53	46,19	56,33	46,43	56,13	46,68	73
74	57,51	46,57	57,31	46,82	57,10	47,07	56,89	47,32	74
75	58,29	47,20	58,08	47,45	57,87	47,71	57,66	47,96	75
76	59,06	47,83	58,85	48,09	58,64	48,34	58,43	48,60	76
77	59,84	48,46	59,63	48,72	59,42	48,98	59,20	49,24	77
78	60,62	49,09	60,40	49,35	60,19	49,61	59,97	49,88	78
79	61,39	49,72	61,18	49,98	60,96	50,25	60,74	50,52	79
80	62,17	50,35	61,95	50,62	61,73	50,89	61,51	51,16	80
81	62,95	50,97	62,73	51,25	62,50	51,52	62,28	51,79	81
82	63,73	51,60	63,50	51,88	63,27	52,16	63,04	52,43	82
83	64,50	52,23	64,27	52,51	64,04	52,79	63,81	53,07	83
84	65,28	52,86	65,05	53,15	64,82	53,43	64,58	53,71	84
85	66,06	53,49	65,82	53,78	65,59	54,07	65,35	54,35	85
86	66,83	54,12	66,60	54,41	66,36	54,70	66,12	54,99	86
87	67,61	54,75	67,37	55,05	67,13	55,34	66,89	55,63	87
88	68,39	55,38	68,15	55,68	67,90	55,97	67,66	56,27	88
89	69,17	56,01	68,92	56,32	68,67	56,61	68,43	56,91	89
90	69,94	56,64	69,70	56,94	69,45	57,25	69,20	57,55	90
91	70,72	57,27	70,47	57,58	70,22	57,88	69,96	58,19	91
92	71,50	57,90	71,24	58,21	70,99	58,52	70,73	58,83	92
93	72,27	58,53	72,02	58,84	71,76	59,16	71,50	59,47	93
94	73,05	59,16	72,79	59,47	72,53	59,79	72,27	60,11	94
95	73,83	59,79	73,57	60,11	73,30	60,43	73,04	60,75	95
96	74,61	60,41	74,34	60,74	74,08	61,06	73,81	61,39	96
97	75,38	61,04	75,12	61,37	74,85	61,70	74,58	62,03	97
98	76,16	61,67	75,89	62,01	75,62	62,34	75,35	62,66	98
99	76,94	62,30	76,66	62,64	76,39	62,97	76,12	63,30	99
100	77,71	62,93	77,44	63,27	77,16	63,61	76,88	63,94	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	51 Deg.		50¾ Deg.		50½ Deg.		50¼ Deg.		

Dift.	40 Deg. Lat.	40 Deg. Dep.	40¼ Deg. Lat.	40¼ Deg. Dep.	40½ Deg. Lat.	40½ Deg. Dep.	40¾ Deg. Lat.	40¾ Deg. Dep.	Dift.
1	0,77	0,64	0,76	0,65	0,76	0,65	0,76	0,65	1
2	1,53	1,29	1,53	1,29	1,52	1,30	1,52	1,31	2
3	2,30	1,93	2,29	1,94	2,28	1,95	2,27	1,96	3
4	3,06	2,57	3,05	2,58	3,04	2,60	3,03	2,61	4
5	3,83	3,21	3,82	3,23	3,80	3,25	3,79	3,26	5
6	4,60	3,86	4,58	3,88	4,56	3,90	4,55	3,92	6
7	5,36	4,50	5,34	4,52	5,32	4,55	5,30	4,57	7
8	6,13	5,14	6,11	5,17	6,08	5,20	6,06	5,22	8
9	6,89	5,79	6,87	5,82	6,84	5,84	6,82	5,87	9
10	7,66	6,43	7,63	6,46	7,60	6,49	7,58	6,53	10
11	8,43	7,07	8,40	7,11	8,36	7,14	8,33	7,18	11
12	9,19	7,71	9,16	7,75	9,12	7,79	9,09	7,83	12
13	9,96	8,36	9,92	8,40	9,89	8,44	9,85	8,49	13
14	10,72	9,00	10,69	9,05	10,65	9,09	10,61	9,14	14
15	11,49	9,64	11,45	9,69	11,41	9,74	11,36	9,79	15
16	12,26	10,28	12,21	10,34	12,17	10,39	12,12	10,44	16
17	13,02	10,93	12,97	10,98	12,93	11,04	12,88	11,10	17
18	13,79	11,57	13,74	11,63	13,69	11,69	13,64	11,75	18
19	14,55	12,21	14,50	12,28	14,45	12,34	14,39	12,40	19
20	15,32	12,86	15,26	12,92	15,21	12,99	15,15	13,06	20
21	16,09	13,50	16,03	13,57	15,97	13,64	15,91	13,71	21
22	16,85	14,14	16,79	14,21	16,73	14,29	16,67	14,36	22
23	17,62	14,78	17,55	14,86	17,49	14,94	17,42	15,01	23
24	18,39	15,43	18,32	15,51	18,25	15,59	18,18	15,67	24
25	19,15	16,07	19,08	16,15	19,01	16,24	18,94	16,32	25
26	19,92	16,71	19,84	16,80	19,77	16,89	19,70	16,97	26
27	20,68	17,36	20,61	17,45	20,53	17,54	20,45	17,62	27
28	21,45	18,00	21,37	18,09	21,29	18,18	21,21	18,28	28
29	22,22	18,64	22,13	18,74	22,05	18,83	21,97	18,93	29
30	22,98	19,28	22,90	19,38	22,81	19,48	22,73	19,58	30
31	23,75	19,93	23,66	20,03	23,57	20,13	23,48	20,24	31
32	24,51	20,57	24,42	20,68	24,33	20,78	24,24	20,89	32
33	25,28	21,21	25,19	21,32	25,09	21,43	25,00	21,54	33
34	26,05	21,85	25,95	21,97	25,85	22,08	25,76	22,19	34
35	26,81	22,50	26,71	22,61	26,61	22,73	26,51	22,85	35
36	27,58	23,14	27,48	23,26	27,37	23,38	27,27	23,50	36
37	28,34	23,78	28,24	23,91	28,13	24,03	28,03	24,15	37
38	29,11	24,43	29,00	24,55	28,90	24,68	28,79	24,80	38
39	29,88	25,07	29,77	25,20	29,66	25,33	29,54	25,46	39
40	30,64	25,71	30,53	25,84	30,42	25,98	30,30	26,11	40
41	31,41	26,35	31,29	26,49	31,18	26,63	31,06	26,76	41
42	32,17	27,00	32,06	27,14	31,94	27,28	31,82	27,42	42
43	32,94	27,64	32,82	27,78	32,70	27,93	32,58	28,07	43
44	33,71	28,28	33,58	28,43	33,46	28,58	33,33	28,72	44
45	34,47	28,93	34,35	29,08	34,22	29,23	34,09	29,37	45
46	35,24	29,57	35,11	29,72	34,98	29,87	34,85	30,03	46
47	36,00	30,21	35,87	30,37	35,74	30,52	35,61	30,68	47
48	36,77	30,85	36,64	31,01	36,50	31,17	36,36	31,33	48
49	37,54	31,50	37,40	31,66	37,26	31,82	37,12	31,99	49
50	38,30	32,14	38,16	32,31	38,02	32,47	37,88	32,64	50
Dift.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dift.
	50 Deg.		49¾ Deg.		49½ Deg.		49¼ Deg.		

Dist.	40 Deg.		40¼ Deg.		40½ Deg.		40¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	39,07	32,78	38,92	32,95	38,78	33,12	38,64	33,29	51
52	39,83	33,42	39,69	33,60	39,54	33,77	39,39	33,94	52
53	40,60	34,07	40,45	34,24	40,30	34,42	40,15	34,60	53
54	41,37	34,71	41,21	34,89	41,06	35,07	40,91	35,25	54
55	42,13	35,35	41,98	35,54	41,82	35,72	41,67	35,90	55
56	42,90	36,00	42,74	36,18	42,58	36,37	42,42	36,55	56
57	43,66	36,64	43,50	36,83	43,34	37,02	43,18	37,21	57
58	44,43	37,28	44,27	37,48	44,10	37,67	43,94	37,86	58
59	45,20	37,92	45,03	38,12	44,86	38,32	44,70	38,51	59
60	45,96	38,57	45,79	38,77	45,62	38,97	45,45	39,17	60
61	46,73	39,21	46,56	39,41	46,38	39,62	46,21	39,82	61
62	47,49	39,85	47,32	40,06	47,15	40,27	46,97	40,47	62
63	48,26	40,50	48,08	40,71	47,91	40,92	47,73	41,12	63
64	49,03	41,14	48,85	41,35	48,67	41,56	48,48	41,78	64
65	49,79	41,78	49,61	42,00	49,43	42,21	49,24	42,43	65
66	50,56	42,42	50,37	42,64	50,19	42,86	50,00	43,08	66
67	51,32	43,07	51,14	43,29	50,95	43,51	50,76	43,73	67
68	52,09	43,71	51,90	43,94	51,71	44,16	51,51	44,39	68
69	52,86	44,35	52,66	44,58	52,47	44,81	52,27	45,04	69
70	53,62	45,00	53,43	45,23	53,23	45,46	53,03	45,69	70
71	54,39	45,64	54,19	45,87	53,99	46,11	53,79	46,35	71
72	55,16	46,28	54,95	46,52	54,75	46,76	54,54	47,00	72
73	55,92	46,92	55,72	47,17	55,51	47,41	55,30	47,65	73
74	56,69	47,57	56,48	47,81	56,27	48,06	56,06	48,30	74
75	57,45	48,21	57,24	48,46	57,03	48,71	56,82	48,96	75
76	58,22	48,85	58,01	49,11	57,79	49,36	57,57	49,61	76
77	58,99	49,49	58,77	49,75	58,55	50,01	58,33	50,26	77
78	59,75	50,14	59,53	50,40	59,31	50,66	59,09	50,92	78
79	60,52	50,78	60,30	51,04	60,07	51,31	59,85	51,57	79
80	61,28	51,42	61,06	51,69	60,83	51,96	60,61	52,22	80
81	62,05	52,07	61,82	52,34	61,59	52,61	61,36	52,87	81
82	62,82	52,71	62,59	52,98	62,35	53,25	62,12	53,53	82
83	63,58	53,35	63,35	53,63	63,11	53,90	62,88	54,18	83
84	64,35	53,99	64,11	54,27	63,87	54,55	63,64	54,83	84
85	65,11	54,64	64,87	54,92	64,63	55,20	64,39	55,48	85
86	65,88	55,28	65,64	55,57	65,39	55,85	65,15	56,14	86
87	66,65	55,92	66,40	56,21	66,16	56,50	65,91	56,79	87
88	67,41	56,57	67,16	56,86	66,92	57,15	66,67	57,44	88
89	68,18	57,21	67,93	57,50	67,68	57,80	67,42	58,10	89
90	68,94	57,85	68,69	58,15	68,44	58,45	68,18	58,75	90
91	69,71	58,49	69,45	58,80	69,20	59,10	68,94	59,40	91
92	70,48	59,14	70,22	59,44	69,96	59,75	69,70	60,05	92
93	71,24	59,78	70,98	60,09	70,72	60,40	70,45	60,71	93
94	72,01	60,42	71,74	60,74	71,48	61,05	71,21	61,36	94
95	72,77	61,06	72,51	61,38	72,24	61,70	71,97	62,01	95
96	73,54	61,71	73,27	62,03	73,00	62,35	72,73	62,66	96
97	74,31	62,35	74,03	62,67	73,76	63,00	73,48	63,32	97
98	75,07	62,99	74,80	63,32	74,52	63,65	74,24	63,97	98
99	75,84	63,64	75,56	63,97	75,28	64,30	75,00	64,62	99
100	76,60	64,28	76,32	64,61	76,04	64,94	75,76	65,28	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat	Dist.
	50 Deg.		49¾ Deg.		49½ Deg.		49¼ Deg.		

Dist.	41 Deg. Lat.	41 Deg. Dep.	41¼ Deg. Lat.	41¼ Deg. Dep.	41½ Deg. Lat.	41½ Deg. Dep.	41¾ Deg. Lat.	41¾ Deg. Dep.	Dist.
1	0,75	0,66	0,75	0,66	0,75	0,66	0,75	0,67	1
2	1,51	1,31	1,50	1,32	1,50	1,33	1,49	1,33	2
3	2,26	1,97	2,26	1,98	2,25	1,99	2,24	2,00	3
4	3,02	2,62	3,01	2,64	3,00	2,65	2,98	2,66	4
5	3,77	3,28	3,76	3,30	3,74	3,31	3,73	3,33	5
6	4,53	3,94	4,51	3,96	4,49	3,98	4,48	4,00	6
7	5,28	4,59	5,26	4,62	5,24	4,64	5,22	4,66	7
8	6,04	5,25	6,01	5,27	5,99	5,30	5,97	5,33	8
9	6,79	5,90	6,77	5,93	6,74	5,96	6,71	5,99	9
10	7,55	6,56	7,52	6,59	7,49	6,63	7,46	6,66	10
11	8,30	7,22	8,27	7,25	8,24	7,29	8,21	7,32	11
12	9,06	7,87	9,02	7,91	8,99	7,95	8,95	7,99	12
13	9,81	8,53	9,77	8,57	9,74	8,61	9,70	8,66	13
14	10,57	9,18	10,53	9,23	10,49	9,28	10,44	9,32	14
15	11,32	9,84	11,28	9,89	11,23	9,94	11,19	9,99	15
16	12,08	10,50	12,03	10,55	11,98	10,60	11,94	10,65	16
17	12,83	11,15	12,78	11,21	12,73	11,26	12,68	11,32	17
18	13,58	11,81	13,53	11,87	13,48	11,93	13,43	11,99	18
19	14,34	12,47	14,28	12,53	14,23	12,59	14,18	12,65	19
20	15,09	13,12	15,04	13,19	14,98	13,25	14,92	13,32	20
21	15,85	13,78	15,79	13,85	15,73	13,91	15,67	13,98	21
22	16,60	14,43	16,54	14,51	16,48	14,58	16,41	14,65	22
23	17,36	15,09	17,29	15,16	17,23	15,24	17,16	15,32	23
24	18,11	15,75	18,04	15,82	17,97	15,90	17,91	15,98	24
25	18,87	16,40	18,80	16,48	18,72	16,57	18,65	16,65	25
26	19,62	17,06	19,55	17,14	19,47	17,23	19,40	17,31	26
27	20,38	17,71	20,30	17,80	20,22	17,89	20,14	17,98	27
28	21,13	18,37	21,05	18,46	20,97	18,55	20,89	18,64	28
29	21,89	19,03	21,80	19,12	21,72	19,22	21,64	19,31	29
30	22,64	19 68	22,56	19,78	22,47	19,88	22,38	19,98	30
31	23,40	20,34	23,31	20,44	23,22	20,54	23,13	20,64	31
32	24,15	20,99	24,06	21,10	23,97	21,20	23,87	21,31	32
33	24,91	21,65	24,81	21,76	24,72	21,87	24,62	21,97	33
34	25,66	22,31	25,56	22,42	25,46	22,53	25,37	22,64	34
35	26,41	22,96	26,31	23,08	26,21	23,19	26,11	23,31	35
36	27,17	23,62	27,07	23,74	26,96	23,85	26,86	23,97	36
37	27,92	24,27	27,82	24,40	27,71	24,52	27,60	24,64	37
38	28,68	24,93	28,57	25,06	28,46	25,18	28,35	25,30	38
39	29,43	25,59	29,32	25,71	29,21	25,84	29,10	25,97	39
40	30,19	26,24	30,07	26,37	29,96	26,50	29,84	26,64	40
41	30,94	26,90	30,83	27,03	30,71	27,17	30,59	27,30	41
42	31,70	27,55	31,58	27,69	31,46	27,83	31,33	27,97	42
43	32,45	28,21	32,33	28,35	32,21	28,49	32,08	28,63	43
44	33,21	28,87	33,08	29,01	32,95	29,16	32,83	29,30	44
45	33,96	29,52	33,83	29,67	33,70	29,82	33,57	29,97	45
46	34,72	30,18	34,58	30,33	34,45	30,48	34,32	30,63	46
47	35,47	30,83	35,34	30,99	35,20	31,14	35,06	31,30	47
48	36,23	31,49	36,09	31,65	35,95	31,81	35,81	31,96	48
49	36,98	32,15	36,84	32,31	36,70	32,47	36,56	32,63	49
50	37,74	32,80	37,59	32,97	37,45	33,13	37,30	33,29	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	49 Deg.		48¾ Deg.		48½ Deg.		48¼ Deg.		

Dist.	41 Deg. Lat.	41 Deg. Dep.	41¼ Deg. Lat.	41¼ Deg. Dep.	41½ Deg. Lat.	41½ Deg. Dep.	41¾ Deg. Lat.	41¾ Deg. Dep.	Dist.
51	38,49	33,46	38,34	33,63	38,20	33,79	38,05	33,96	51
52	39,24	34,12	39,10	34,29	38,95	34,46	38,79	34,63	52
53	40,00	34,77	39,85	34,95	39,69	35,12	39,54	35,29	53
54	40,75	35,43	40,60	35,60	40,44	35,78	40,29	35,96	54
55	41,51	36,08	41,35	36,26	41,19	36,44	41,03	36,62	55
56	42,26	36,74	42,10	36,92	41,94	37,11	41,78	37,29	56
57	43,02	37,40	42,85	37,58	42,69	37,77	42,53	37,96	57
58	43,77	38,05	43,61	38,24	43,44	38,43	43,27	38,62	58
59	44,53	38,71	44,36	38,90	44,19	39,09	44,02	39,29	59
60	45,28	39,36	45,11	39,56	44,94	39,76	44,76	39,95	60
61	46,04	40,02	45,86	40,22	45,69	40,42	45,51	40,62	61
62	46,79	40,68	46,61	40,88	46,44	41,08	46,26	41,28	62
63	47,55	41,33	47,37	41,54	47,18	41,75	47,00	41,95	63
64	48,30	41,99	48,12	42,20	47,93	42,41	47,75	42,62	64
65	49,06	42,64	48,87	42,86	48,68	43,07	48,49	43,28	65
66	49,81	43,30	49,62	43,52	49,43	43,73	49,24	43,95	66
67	50,57	43,96	50,37	44,18	50,18	44,40	49,99	44,61	67
68	51,32	44,61	51,13	44,84	50,93	45,06	50,73	45,28	68
69	52,07	45,27	51,88	45,49	51,68	45,72	51,48	45,95	69
70	52,83	45,92	52,63	46,15	52,43	46,38	52,22	46,61	70
71	53,58	46,58	53,38	46,81	53,18	47,05	52,97	47,28	71
72	54,34	47,24	54,13	47,47	53,92	47,71	53,72	47,94	72
73	55,09	47,89	54,88	48,13	54,67	48,37	54,46	48,61	73
74	55,85	48,55	55,64	48,79	55,42	49,03	55,21	49,28	74
75	56,60	49,20	56,39	49,45	56,17	49,70	55,95	49,94	75
76	57,36	49,86	57,14	50,11	56,92	50,36	56,70	50,61	76
77	58,11	50,52	57,89	50,77	57,67	51,02	57,45	51,27	77
78	58,87	51,17	58,64	51,43	58,42	51,68	58,19	51,94	78
79	59,62	51,83	59,40	52,09	59,17	52,35	58,94	52,60	79
80	60,38	52,48	60,15	52,75	59,92	53,01	59,68	53,27	80
81	61,13	53,14	60,90	53,41	60,67	53,67	60,43	53,94	81
82	61,89	53,80	61,65	54,07	61,41	54,33	61,18	54,60	82
83	62,64	54,45	62,40	54,73	62,16	55,00	61,92	55,27	83
84	63,40	55,11	63,15	55,38	62,91	55,66	62,67	55,93	84
85	64,15	55,76	63,91	56,04	63,66	56,32	63,41	56,60	85
86	64,90	56,42	64,66	56,70	64,41	56,99	64,16	57,27	86
87	65,66	57,08	65,41	57,36	65,16	57,65	64,91	57,93	87
88	66,41	57,73	66,16	58,02	65,91	58,31	65,65	58,60	88
89	67,17	58,39	66,91	58,68	66,66	58,97	66,40	59,26	89
90	67,92	59,05	67,67	59,34	67,41	59,64	67,15	59,93	90
91	68,68	59,70	68,42	60,00	68,15	60,30	67,89	60,60	91
92	69,43	60,36	69,17	60,66	68,90	60,96	68,64	61,26	92
93	70,19	61,01	69,92	61,32	69,65	61,62	69,38	61,93	93
94	70,94	61,67	70,67	61,98	70,40	62,29	70,13	62,59	94
95	71,70	62,33	71,42	62,64	71,15	62,95	70,88	63,26	95
96	72,45	62,98	72,18	63,30	71,90	63,61	71,62	63,92	96
97	73,21	63,64	72,93	63,96	72,65	64,27	72,37	64,59	97
98	73,96	64,29	73,68	64,62	73,40	64,94	73,11	65,26	98
99	74,72	64,95	74,43	65,28	74,15	65,60	73,86	65,92	99
100	75,47	65,61	75,18	65,93	74,90	66,26	74,61	66,59	100
Dist.	49 Deg. Dep.	49 Deg. Lat.	48¾ Deg. Dep.	48¾ Deg. Lat.	48½ Deg. Dep.	48½ Deg. Lat.	48¼ Deg. Dep.	48¼ Deg. Lat.	Dist.

Dist.	42 Deg. Lat.	42 Deg. Dep.	42¼ Deg. Lat.	42¼ Deg. Dep.	42½ Deg. Lat.	42½ Deg. Dep.	42¾ Deg. Lat.	42¾ Deg. Dep.	Dist.
1	0,74	0,67	0,74	0,67	0,74	0,68	0,73	0,68	1
2	1,49	1,34	1,48	1,34	1,47	1,35	1,47	1,36	2
3	2,23	2,01	2,22	2,02	2,21	2,03	2,20	2,04	3
4	2,97	2,68	2,96	2,69	2,95	2,70	2,94	2,72	4
5	3,72	3,35	3,70	3,36	3,69	3,38	3,67	3,39	5
6	4,46	4,01	4,44	4,03	4,42	4,05	4,41	4,07	6
7	5,20	4,68	5,18	4,71	5,16	4,73	5,14	4,75	7
8	5,95	5,35	5,92	5,38	5,90	5,40	5,87	5,43	8
9	6,69	6,02	6,66	6,05	6,64	6,08	6,61	6,11	9
10	7,43	6,69	7,40	6,72	7,37	6,76	7,34	6,79	10
11	8,17	7,36	8,14	7,40	8,11	7,43	8,08	7,47	11
12	8,92	8,03	8,88	8,07	8,85	8,11	8,81	8,15	12
13	9,66	8,70	9,62	8,74	9,58	8,78	9,55	8,82	13
14	10,40	9,37	10,36	9,41	10,32	9,46	10,28	9,50	14
15	11,15	10,04	11,10	10,09	11,06	10,13	11,01	10,18	15
16	11,89	10,71	11,84	10,76	11,80	10,81	11,75	10,86	16
17	12,63	11,38	12,58	11,43	12,53	11,48	12,48	11,54	17
18	13,38	12,04	13,32	12,10	13,27	12,16	13,22	12,22	18
19	14,12	12,71	14,06	12,77	14,01	12,84	13,95	12,90	19
20	14,86	13,38	14,80	13,45	14,75	13,51	14,69	13,58	20
21	15,61	14,05	15,54	14,12	15,48	14,19	15,42	14,25	21
22	16,35	14,72	16,28	14,79	16,22	14,86	16,16	14,93	22
23	17,09	15,39	17,02	15,46	16,96	15,54	16,89	15,61	23
24	17,84	16,06	17,77	16,14	17,69	16,21	17,62	16,29	24
25	18,58	16,73	18,51	16,81	18,43	16,89	18,36	16,97	25
26	19,32	17,40	19,25	17,48	19,17	17,57	19,09	17,65	26
27	20,06	18,07	19,99	18,15	19,91	18,24	19,83	18,33	27
28	20,81	18,74	20,73	18,83	20,64	18,92	20,56	19,01	28
29	21,55	19,40	21,47	19,50	21,38	19,59	21,30	19,69	29
30	22,29	20,07	22,21	20,17	22,12	20,27	22,03	20,36	30
31	23,04	20,74	22,95	20,84	22,86	20,94	22,76	21,04	31
32	23,78	21,41	23,69	21,52	23,59	21,62	23,50	21,72	32
33	24,52	22,08	24,43	22,19	24,33	22,29	24,23	22,40	33
34	25,27	22,75	25,17	22,86	25,07	22,97	24,97	23,08	34
35	26,01	23,42	25,91	23,53	25,80	23,65	25,70	23,76	35
36	26,75	24,09	26,65	24,21	26,54	24,32	26,44	24,44	36
37	27,50	24,76	27,39	24,88	27,28	25,00	27,17	25,12	37
38	28,24	25,43	28,13	25,55	28,02	25,67	27,90	25,79	38
39	28,98	26,10	28,87	26,22	28,75	26,35	28,64	26,47	39
40	29,73	26,77	29,61	26,89	29,49	27,02	29,37	27,15	40
41	30,47	27,43	30,35	27,57	30,23	27,70	30,11	27,83	41
42	31,21	28,10	31,09	28,24	30,97	28,37	30,84	28,51	42
43	31,96	28,77	31,83	28,91	31,70	29,05	31,58	29,19	43
44	32,70	29,44	32,57	29,58	32,44	29,73	32,31	29,87	44
45	33,44	30,11	33,31	30,26	33,18	30,40	33,04	30,55	45
46	34,18	30,78	34,05	30,93	33,91	31,08	33,78	31,22	46
47	34,93	31,45	34,79	31,60	34,65	31,75	34,51	31,90	47
48	35,67	32,12	35,53	32,27	35,39	32,43	35,25	32,58	48
49	36,41	32,79	36,27	32,95	36,13	33,10	35,98	33,26	49
50	37,16	33,46	37,01	33,62	36,86	33,78	36,72	33,94	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	48 Deg.		47¾ Deg.		47½ Deg.		47¼ Deg.		

Dist.	42 Deg.		42¼ Deg.		42½ Deg.		42¾ Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	37,90	34,13	37,75	34,29	37,60	34,46	37,45	34,62	51
52	38,64	34,79	38,49	34,96	38,34	35,13	38,18	35,30	52
53	39,39	35,46	39,23	35,64	39,08	35,81	38,92	35,98	53
54	40,13	36,13	39,97	36,31	39,81	36,48	39,65	36,66	54
55	40,87	36,80	40,71	36,98	40,55	37,16	40,39	37,33	55
56	41,62	37,47	41,45	37,65	41,29	37,83	41,12	38,01	56
57	42,36	38,14	42,19	38,32	42,02	38,51	41,86	38,69	57
58	43,10	38,81	42,93	39,00	42,76	39,18	42,59	39,37	58
59	43,85	39,48	43,67	39,67	43,50	39,86	43,32	40,05	59
60	44,59	40,15	44,41	40,34	44,24	40,54	44,06	40,73	60
61	45,33	40,82	45,15	41,01	44,97	41,21	44,79	41,41	61
62	46,07	41,49	45,89	41,69	45,71	41,89	45,53	42,09	62
63	46,82	42,16	46,63	42,36	46,45	42,56	46,26	42,76	63
64	47,56	42,82	47,37	43,03	47,19	43,24	47,00	43,44	64
65	48,30	43,49	48,11	43,70	47,92	43,91	47,73	44,12	65
66	49,05	44,16	48,85	44,38	48,66	44,59	48,47	44,80	66
67	49,79	44,83	49,59	45,05	49,40	45,26	49,20	45,48	67
68	50,53	45,50	50,33	45,72	50,13	45,94	49,93	46,16	68
69	51,28	46,17	51,07	46,39	50,87	46,62	50,67	46,84	69
70	52,02	46,84	51,82	47,07	51,61	47,29	51,40	47,52	70
71	52,76	47,51	52,56	47,74	52,35	47,97	52,14	48,19	71
72	53,51	48,18	53,30	48,41	53,08	48,64	52,87	48,87	72
73	54,25	48,85	54,04	49,08	53,82	49,32	53,61	49,55	73
74	54,99	49,52	54,78	49,76	54,56	49,99	54,34	50,23	74
75	55,74	50,18	55,52	50,43	55,30	50,67	55,07	50,91	75
76	56,48	50,85	56,26	51,10	56,03	51,34	55,81	51,59	76
77	57,22	51,52	57,00	51,77	56,77	52,02	56,54	52,27	77
78	57,97	52,19	57,74	52,44	57,51	52,70	57,28	52,95	78
79	58,71	52,86	58,48	53,12	58,24	53,37	58,01	53,63	79
80	59,45	53,53	59,22	53,79	58,98	54,05	58,75	54,30	80
81	60,19	54,20	59,96	54,46	59,72	54,72	59,48	54,98	81
82	60,94	54,87	60,70	55,13	60,46	55,40	60,21	55,66	82
83	61,68	55,54	61,44	55,81	61,19	56,07	60,95	56,34	83
84	62,42	56,21	62,18	56,48	61,93	56,75	61,68	57,02	84
85	63,17	56,88	62,92	57,15	62,67	57,43	62,42	57,70	85
86	63,91	57,55	63,66	57,82	63,41	58,10	63,15	58,38	86
87	64,65	58,21	64,40	58,50	64,14	58,78	63,89	59,06	87
88	65,40	58,88	65,14	59,17	64,88	59,45	64,62	59,73	88
89	66,14	59,55	65,88	59,84	65,62	60,13	65,35	60,41	89
90	66,88	60,22	66,62	60,51	66,35	60,80	66,09	61,09	90
91	67,63	60,89	67,36	61,19	67,09	61,48	66,82	61,77	91
92	68,37	61,56	68,10	61,86	67,83	62,15	67,56	62,45	92
93	69,11	62,23	68,84	62,53	68,57	62,83	68,29	63,13	93
94	69,86	62,90	69,58	63,20	69,30	63,51	69,03	63,81	94
95	70,60	63,57	70,32	63,87	70,04	64,18	69,76	64,49	95
96	71,34	64,24	71,06	64,55	70,78	64,86	70,49	65,16	96
97	72,08	64,91	71,80	65,22	71,52	65,53	71,23	65,84	97
98	72,83	65,57	72,54	65,89	72,25	66,21	71,96	66,52	98
99	73,57	66,24	73,28	66,56	72,99	66,88	72,70	67,20	99
100	74,31	66,91	74,02	67,24	73,73	67,56	73,43	67,88	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat	Dist.
	48 Deg.		47¾ Deg.		47½ Deg.		47¼ Deg.		

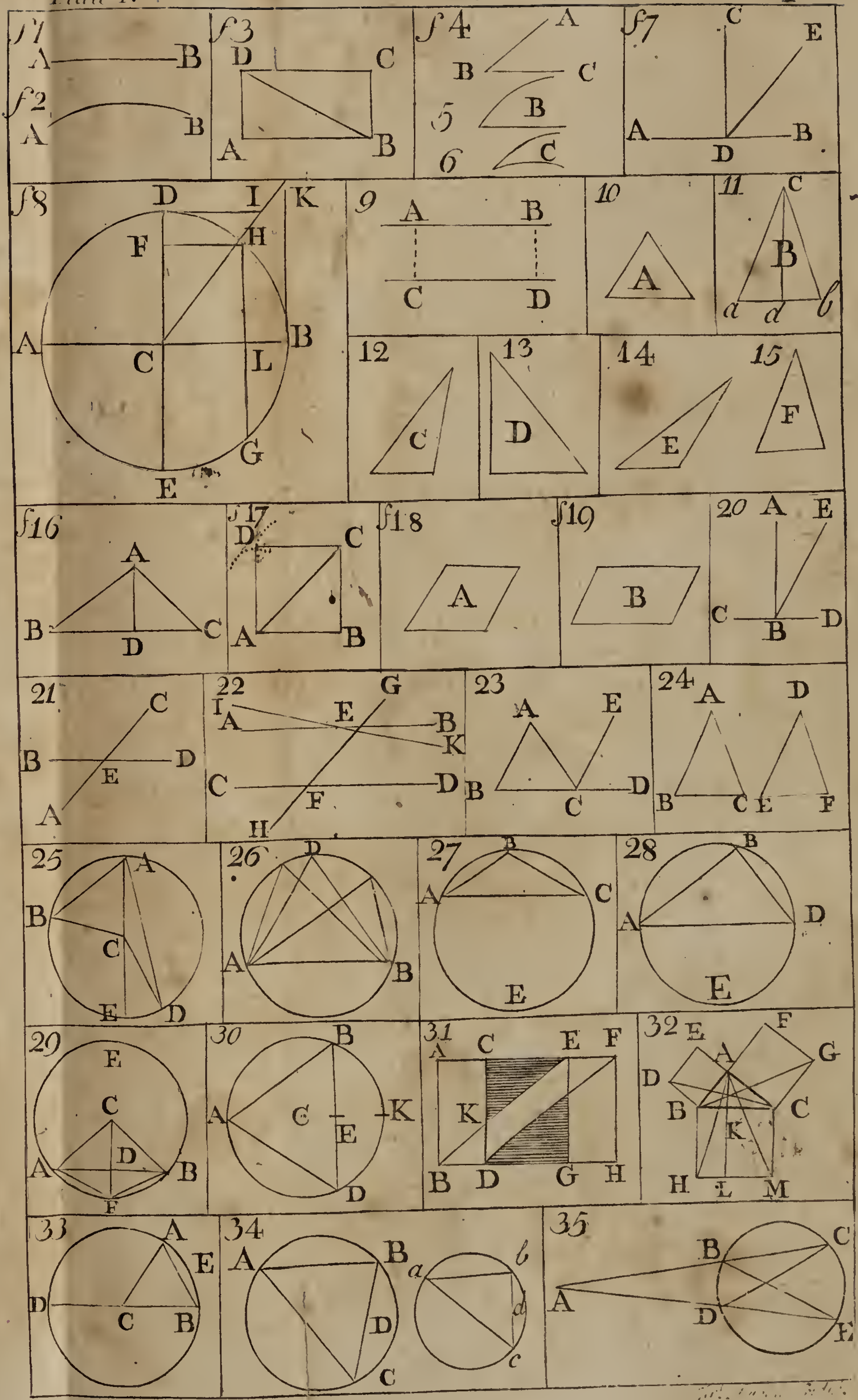
Dist.	43 Deg. Lat.	43 Deg. Dep.	43¼ Deg. Lat.	43¼ Deg. Dep.	43½ Deg. Lat.	43½ Deg. Dep.	43¾ Deg. Lat.	43¾ Deg. Dep.	Dist.
1	0,73	0,68	0,73	0,69	0,73	0,69	0,72	0,69	1
2	1,46	1,36	1,46	1,37	1,45	1,38	1,44	1,38	2
3	2,19	2,05	2,19	2,06	2,18	2,07	2,17	2,07	3
4	2,93	2,73	2,91	2,74	2,90	2,75	2,89	2,77	4
5	3,66	3,41	3,64	3,43	3,63	3,44	3,61	3,46	5
6	4,39	4,09	4,37	4,11	4,35	4,13	4,33	4,15	6
7	5,12	4,77	5,10	4,80	5,08	4,82	5,06	4,84	7
8	5,85	5,46	5,83	5,48	5,80	5,51	5,78	5,53	8
9	6,58	6,14	6,56	6,17	6,53	6,20	6,50	6,22	9
10	7,31	6,82	7,28	6,85	7,25	6,88	7,22	6,92	10
11	8,04	7,50	8,01	7,54	7,98	7,57	7,95	7,61	11
12	8,78	8,18	8,74	8,22	8,70	8,26	8,67	8,30	12
13	9,51	8,87	9,47	8,91	9,43	8,95	9,39	8,99	13
14	10,24	9,55	10,20	9,59	10,16	9,64	10,11	9,68	14
15	10,97	10,23	10,93	10,28	10,88	10,33	10,84	10,37	15
16	11,70	10,91	11,65	10,96	11,61	11,01	11,56	11,06	16
17	12,43	11,59	12,38	11,65	12,33	11,70	12,28	11,76	17
18	13,16	12,28	13,11	12,33	13,06	12,39	13,00	12,45	18
19	13,90	12,96	13,84	13,02	13,78	13,08	13,72	13,14	19
20	14,63	13,64	14,57	13,70	14,51	13,77	14,45	13,83	20
21	15,36	14,32	15,30	14,39	15,23	14,46	15,17	14,52	21
22	16,09	15,00	16,02	15,07	15,96	15,14	15,89	15,21	22
23	16,82	15,69	16,75	15,76	16,68	15,83	16,61	15,90	23
24	17,55	16,37	17,48	16,44	17,41	16,52	17,34	16,60	24
25	18,28	17,05	18,21	17,13	18,13	17,21	18,06	17,29	25
26	19,02	17,73	18,94	17,81	18,86	17,90	18,78	17,98	26
27	19,75	18,41	19,67	18,50	19,59	18,59	19,50	18,67	27
28	20,48	19,10	20,39	19,19	20,31	19,27	20,23	19,36	28
29	21,21	19,78	21,12	19,87	21,04	19,96	20,95	20,05	29
30	21,94	20,46	21,85	20,56	21,76	20,65	21,67	20,75	30
31	22,67	21,14	22,58	21,24	22,49	21,34	22,39	21,44	31
32	23,40	21,82	23,31	21,93	23,21	22,03	23,12	22,13	32
33	24,13	22,51	24,04	22,61	23,94	22,72	23,84	22,82	33
34	24,87	23,19	24,76	23,30	24,66	23,40	24,56	23,51	34
35	25,60	23,87	25,49	23,98	25,39	24,09	25,28	24,20	35
36	26,33	24,55	26,22	24,67	26,11	24,78	26,01	24,89	36
37	27,06	25,23	26,95	25,35	26,84	25,47	26,73	25,59	37
38	27,79	25,92	27,68	26,04	27,56	26,16	27,45	26,28	38
39	28,52	26,60	28,41	26,72	28,29	26,85	28,17	26,97	39
40	29,25	27,28	29,13	27,41	29,01	27,53	28,89	27,66	40
41	29,99	27,96	29,86	28,09	29,74	28,22	29,62	28,35	41
42	30,72	28,64	30,59	28,78	30,47	28,91	30,34	29,04	42
43	31,45	29,33	31,32	29,46	31,19	29,60	31,06	29,74	43
44	32,18	30,01	32,05	30,15	31,92	30,29	31,78	30,43	44
45	32,91	30,69	32,78	30,83	32,64	30,98	32,51	31,12	45
46	33,64	31,37	33,51	31,52	33,37	31,66	33,23	31,81	46
47	34,37	32,05	34,23	32,20	34,09	32,35	33,95	32,50	47
48	35,10	32,74	34,96	32,89	34,82	33,04	34,67	33,19	48
49	35,84	33,42	35,69	33,57	35,54	33,73	35,40	33,88	49
50	36,57	34,10	36,42	34,26	36,27	34,42	36,12	34,58	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	47 Deg.		46¾ Deg.		46½ Deg.		46¼ Deg.		

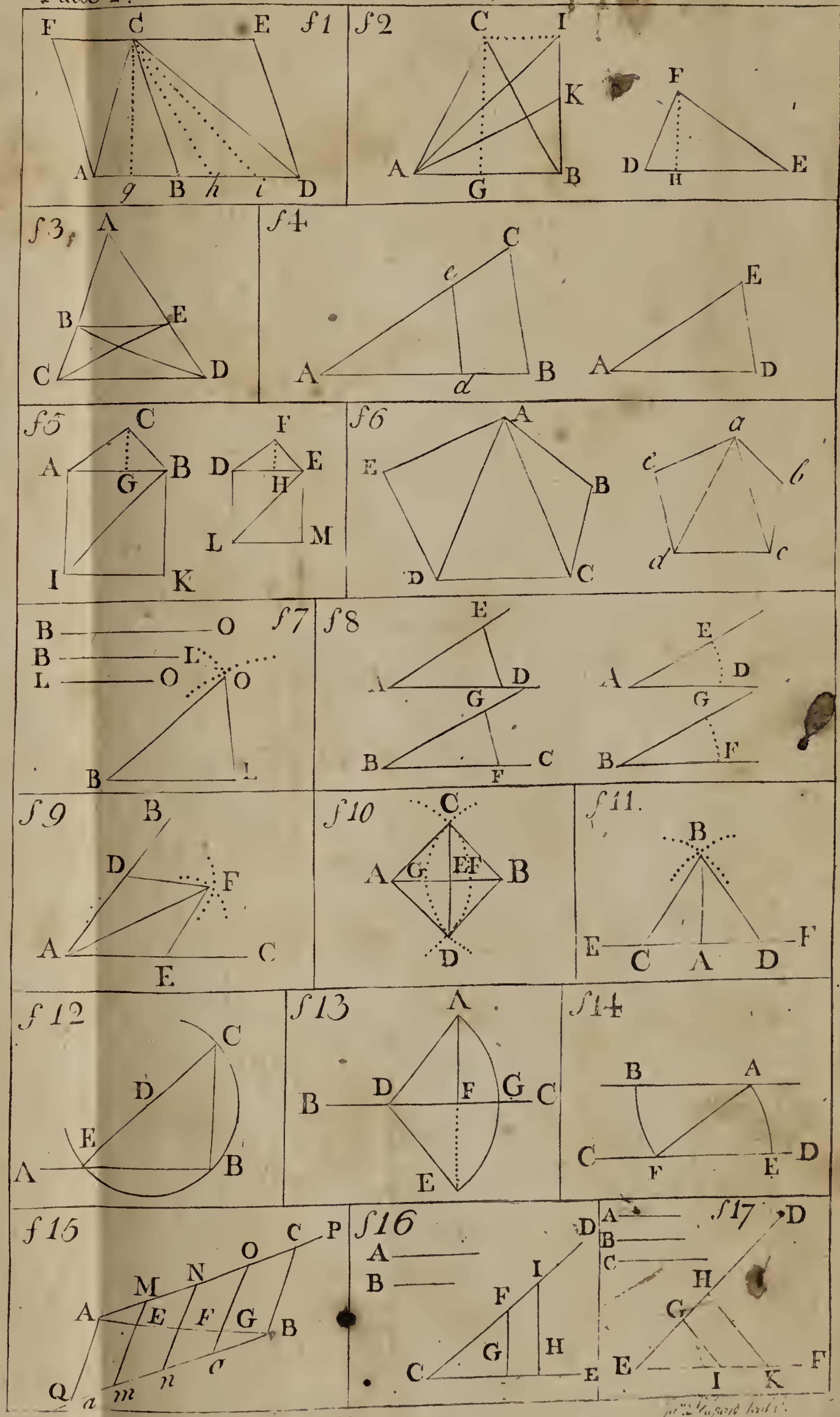
Dist.	43 Deg. Lat.	Dep.	43¼ Deg. Lat	Dep	43½ Deg. Lat.	Dep.	43¾ Deg. Lat.	Dep.	Dist.
51	37,30	34,78	37,15	34,94	36,99	35,11	36,84	35,27	51
52	38,03	35,46	37,88	35,63	37,72	35,79	37,56	35,96	52
53	38,76	36,15	38,60	36,31	38,44	36,48	38,29	36,65	53
54	39,49	36,83	39,33	37,00	39,17	37,17	39,01	37,34	54
55	40,22	37,51	40,06	37,69	39,90	37,86	39,73	38,03	55
56	40,96	38,19	40,79	38,37	40,62	38,55	40,45	38,72	56
57	41,69	38,87	41,52	39,06	41,35	39,24	41,17	39,42	57
58	42,42	39,56	42,25	39,74	42,07	39,92	41,90	40,11	58
59	43,15	40,24	42,97	40,43	42,80	40,61	42,62	40,80	59
60	43,88	40,92	43,70	41,11	43,52	41,30	43,34	41,49	60
61	44,61	41,60	44,43	41,80	44,25	41,99	44,06	42,18	61
62	45,34	42,28	45,16	42,48	44,97	42,68	44,79	42,87	62
63	46,08	42,97	45,89	43,17	45,70	43,37	45,51	43,57	63
64	46,81	43,65	46,62	43,85	46,42	44,05	46,23	44,26	64
65	47,54	44,33	47,34	44,54	47,15	44,74	46,95	44,95	65
66	48,27	45,01	48,07	45,22	47,87	45,43	47,68	45,64	66
67	49,00	45,69	48,80	45,91	48,60	46,12	48,40	46,33	67
68	49,73	46,38	49,53	46,59	49,33	46,81	49,12	47,02	68
69	50,46	47,06	50,26	47,28	50,05	47,50	49,84	47,71	69
70	51,19	47,74	50,99	47,96	50,78	48,18	50,57	48,41	70
71	51,93	48,42	51,71	48,65	51,50	48,87	51,29	49,10	71
72	52,66	49,10	52,44	49,33	52,23	49,56	52,01	49,79	72
73	53,39	49,79	53,17	50,02	52,95	50,25	52,73	50,48	73
74	54,12	50,47	53,90	50,70	53,68	50,94	53,45	51,17	74
75	54,85	51,15	54,63	51,39	54,40	51,63	54,18	51,86	75
76	55,58	51,83	55,36	52,07	55,13	52,31	54,90	52,55	76
77	56,31	52,51	56,08	52,76	55,85	53,00	55,62	53,25	77
78	57,05	53,20	56,81	53,44	56,58	53,69	56,34	53,94	78
79	57,78	53,88	57,54	54,13	57,30	54,38	57,07	54,63	79
80	58,51	54,56	58,27	54,81	58,03	55,07	57,79	55,32	80
81	59,24	55,24	59,00	55,50	58,76	55,76	58,51	56,01	81
82	59,97	55,92	59,73	56,18	59,48	56,45	59,23	56,70	82
83	60,70	56,61	60,45	56,87	60,21	57,13	59,96	57,40	83
84	61,43	57,29	61,18	57,56	60,93	57,82	60,68	58,09	84
85	62,17	57,97	61,91	58,24	61,66	58,51	61,40	58,78	85
86	62,90	58,65	62,64	58,93	62,38	59,20	62,12	59,47	86
87	63,63	59,33	63,37	59,61	63,11	59,89	62,85	60,16	87
88	64,36	60,02	64,10	60,30	63,83	60,58	63,57	60,85	88
89	65,09	60,70	64,82	60,98	64,56	61,26	64,29	61,54	89
90	65,82	61,38	65,55	61,67	65,28	61,95	65,01	62,24	90
91	66,55	62,06	66,28	62,35	66,01	62,64	65,74	62,93	91
92	67,28	62,74	67,01	63,04	66,73	63,33	66,46	63,62	92
93	68,02	63,43	67,74	63,72	67,46	64,02	67,18	64,31	93
94	68,75	64,11	68,47	64,41	68,19	64,71	67,90	65,00	94
95	69,48	64,79	69,20	65,09	68,91	65,39	68,62	65,69	95
96	70,21	65,47	69,92	65,78	69,64	66,08	69,35	66,39	96
97	70,94	66,15	70,65	66,46	70,36	66,77	70,07	67,08	97
98	71,67	66,84	71,38	67,15	71,09	67,46	70,79	67,77	98
99	72,40	67,52	72,11	67,83	71,81	68,15	71,51	68,46	99
100	73,14	68,20	72,84	68,52	72,54	68,84	72,24	69,15	100
Dist.	Dep	Lat.	Dep.	Lat.	Dep.	Lat.	Dep	Lat.	Dist.
	47 Deg.		46¾ Deg.		46½ Deg.		46¼ Deg.		

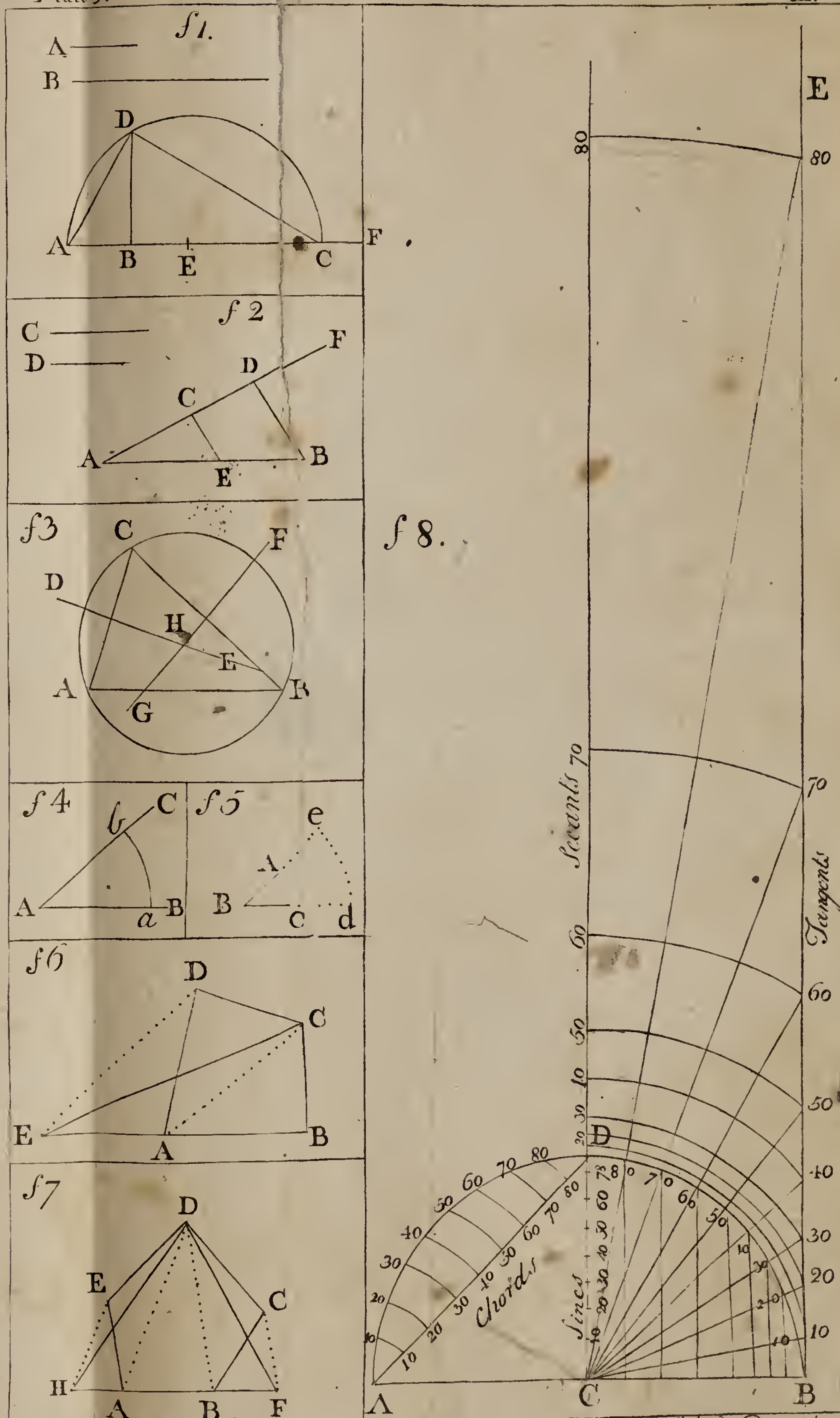
Dist.	44 Deg. Lat.	44 Deg. Dep.	44¼ Deg. Lat.	44¼ Deg. Dep.	44½ Deg. Lat.	44½ Deg. Dep.	44¾ Deg. Lat.	44¾ Deg. Dep.	45 Deg. Lat.	45 Deg. Dep.	Dist.
1	0,72	0,69	0,72	0,70	0,71	0,70	0,71	0,71	0,71	0,71	1
2	1,44	1,39	1,43	1,40	1,43	1,40	1,42	1,41	1,41	1,41	2
3	2,16	2,08	2,15	2,09	2,14	2,10	2,13	2,11	2,12	2,12	3
4	2,88	2,78	2,87	2,79	2,85	2,80	2,84	2,82	2,83	2,83	4
5	3,60	3,47	3,58	3,49	3,57	3,50	3,55	3,52	3,54	3,54	5
6	4,32	4,17	4,30	4,19	4,28	4,21	4,26	4,22	4,24	4,24	6
7	5,04	4,86	5,01	4,88	4,99	4,91	4,97	4,93	4,95	4,95	7
8	5,75	5,56	5,73	5,58	5,71	5,61	5,68	5,63	5,66	5,66	8
9	6,47	6,25	6,45	6,28	6,42	6,31	6,39	6,34	6,36	6,36	9
10	7,19	6,95	7,16	6,98	7,13	7,01	7,10	7,04	7,07	7,07	10
11	7,91	7,64	7,88	7,68	7,85	7,71	7,81	7,74	7,78	7,78	11
12	8,63	8,34	8,60	8,37	8,56	8,41	8,52	8,45	8,49	8,49	12
13	9,35	9,03	9,31	9,07	9,27	9,11	9,23	9,15	9,19	9,19	13
14	10,07	9,73	10,03	9,77	9,99	9,81	9,94	9,86	9,90	9,90	14
15	10,79	10,42	10,74	10,47	10,70	10,51	10,65	10,56	10,61	10,61	15
16	11,51	11,11	11,46	11,16	11,41	11,21	11,36	11,26	11,31	11,31	16
17	12,23	11,81	12,18	11,86	12,13	11,92	12,07	11,97	12,02	12,02	17
18	12,95	12,50	12,89	12,56	12,84	12,62	12,78	12,67	12,73	12,73	18
19	13,67	13,20	13,61	13,26	13,55	13,32	13,49	13,38	13,43	13,43	19
20	14,39	13,89	14,33	13,96	14,26	14,02	14,20	14,08	14,14	14,14	20
21	15,11	14,59	15,04	14,65	14,98	14,72	14,91	14,78	14,85	14,85	21
22	15,83	15,28	15,76	15,35	15,69	15,42	15,62	15,49	15,56	15,56	22
23	16,54	15,98	16,47	16,05	16,40	16,12	16,33	16,19	16,26	16,26	23
24	17,26	16,67	17,19	16,75	17,12	16,82	17,04	16,90	16,97	16,97	24
25	17,98	17,37	17,91	17,44	17,83	17,52	17,75	17,60	17,68	17,68	25
26	18,70	18,06	18,62	18,14	18,54	18,22	18,46	18,30	18,38	18,38	26
27	19,42	18,76	19,34	18,84	19,26	18,92	19,17	19,01	19,09	19,09	27
28	20,14	19,45	20,06	19,54	19,97	19,63	19,89	19,71	19,80	19 80	28
29	20,86	20,15	20,77	20,24	20,68	20,33	20,60	20,42	20,51	20,51	29
30	21,58	20,84	21,49	20,93	21,40	21,03	21,31	21,12	21,21	21,21	30
31	22,30	21,53	22,21	21,63	22,11	21,73	22,02	21,82	21,92	21,92	31
32	23,02	22,23	22,92	22,33	22,82	22,43	22,73	22,53	22,63	22,63	32
33	23,74	22,92	23,64	23,03	23,54	23,13	23,44	23,23	23,33	23,33	33
34	24,46	23,62	24,35	23,72	24,25	23,83	24,15	23,94	24,04	24,04	34
35	25,18	24,31	25 07	24,42	24,96	24,53	24,86	24,64	24,75	24,75	35
36	25,90	25,01	25,79	25,12	25,68	25,23	25,57	25,34	25,46	25,46	36
37	26,62	25,70	26,50	25,82	26,39	25,93	26,28	26,05	26,16	26 16	37
38	27,33	26,40	27,22	26,52	27,10	26,63	26,99	26,75	26,87	26,87	38
39	28,05	27,09	27,94	27,21	27,82	27,34	27,70	27,46	27,58	27,58	39
40	28,77	27,79	28,65	27,91	28,53	28,04	28,41	28,16	28,28	28,28	40
41	29,49	28,48	29,37	28,61	29,24	28,74	29,12	28,86	28,99	28,99	41
42	30,21	29,18	30,08	29,31	29,96	29,44	29,83	29,57	29,70	29,70	42
43	30,93	29,87	30,80	30,00	30,67	30,14	30,54	30,27	30,41	30,41	43
44	31,65	30,56	31,52	30,70	31,38	30,84	31,25	30,98	31,11	31,11	44
45	32,37	31 26	32,23	31,40	32,10	31,54	31,96	31,68	31,82	31,82	45
46	33,09	31,95	32,95	32,10	32,81	32,24	32,67	32,38	32,53	32,53	46
47	33,81	32,65	33,67	32,80	33,52	32,94	33,38	33,09	33,23	33,23	47
48	34,53	33,34	34,38	33,49	34,24	33,64	34,09	33,79	33,94	33,94	48
49	35,25	34,04	35,10	34,19	34,95	34,34	34,80	34,50	34,65	34,65	49
50	35,97	34,73	35,82	34,89	35,66	35,05	35,51	35,20	35,36	35,36	50
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dist.
	46 Deg.		45¾ Deg.		45½ Deg.		45¼ Deg.		45 Deg.		

Dist.	44 Deg.		44¼ Deg.		44½ Deg.		44¾ Deg.		45 Deg.		Dist.
	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	
51	36,69	35,43	36,53	35,59	36,38	35,75	36,22	35,90	36,06	36,06	51
52	37,41	36,12	37,25	36,29	37,09	36,45	36,93	36,61	36,77	36,77	52
53	38,12	36,82	37,96	36,98	37,80	37,15	37,64	37,31	37,48	37,48	53
54	38,84	37,51	38,68	37,68	38,52	37,85	38,35	38,02	38,18	38,18	54
55	39,56	38,21	39,40	38,38	39,23	38,55	39,06	38,72	38,89	38,89	55
56	40,28	38,90	40,11	39,08	39,94	39,25	39,77	39,42	39,60	39,60	56
57	41,00	39,60	40,83	39,77	40,66	39,95	40,48	40,13	40,31	40,31	57
58	41,72	40,29	41,55	40,47	41,37	40,65	41,19	40,83	41,01	41,01	58
59	42,44	40,98	42,26	41,17	42,08	41,35	41,90	41,54	41,72	41,72	59
60	43,16	41,68	42,98	41,87	42,79	42,05	42,61	42,24	42,43	42,43	60
61	43,88	42,37	43,69	42,57	43,51	42,76	43,32	42,94	43,13	43,13	61
62	44,60	43,07	44,41	43,26	44,22	43,46	44,03	43,65	43,84	43,84	62
63	45,32	43,76	45,13	43,96	44,93	44,16	44,74	44,35	44,55	44,55	63
64	46,04	44,46	45,84	44,66	45,65	44,86	45,45	45,06	45,25	45,25	64
65	46,76	45,15	46,56	45,36	46,36	45,56	46,16	45,76	45,96	45,96	65
66	47,48	45,85	47,28	46,05	47,07	46,26	46,87	46,46	46,67	46,67	66
67	48,20	46,54	47,99	46,75	47,79	46,96	47,58	47,17	47,38	47,38	67
68	48,92	47,24	48,71	47,45	48,50	47,66	48,29	47,87	48,08	48,08	68
69	49,63	47,93	49,42	48,15	49,21	48,36	49,00	48,58	48,79	48,79	69
70	50,35	48,63	50,14	48,85	49,93	49,06	49,71	49,28	49,50	49,50	70
71	51,07	49,32	50,86	49,54	50,64	49,76	50,42	49,98	50,20	50,20	71
72	51,79	50,02	51,57	50,24	51,35	50,47	51,13	50,69	50,91	50,91	72
73	52,51	50,71	52,29	50,94	52,07	51,17	51,84	51,39	51,62	51,62	73
74	53,23	51,40	53,01	51,64	52,78	51,87	52,55	52,10	52,33	52,33	74
75	53,95	52,10	53,72	52,33	53,49	52,57	53,26	52,80	53,03	53,03	75
76	54,67	52,79	54,44	53,03	54,21	53,27	53,97	53,51	53,74	53,74	76
77	55,39	53,49	55,16	53,73	54,92	53,97	54,68	54,21	54,45	54,45	77
78	56,11	54,18	55,87	54,43	55,63	54,67	55,39	54,91	55,15	55,15	78
79	56,83	54,88	56,59	55,13	56,35	55,37	56,10	55,62	55,86	55,86	79
80	57,55	55,57	57,30	55,82	57,06	56,07	56,81	56,32	56,57	56,57	80
81	58,27	56,27	58,02	56,52	57,77	56,77	57,52	57,03	57,28	57,28	81
82	58,99	56,96	58,74	57,22	58,49	57,47	58,24	57,73	57,98	57,98	82
83	59,71	57,66	59,45	57,92	59,20	58,18	58,95	58,43	58,69	58,69	83
84	60,42	58,35	60,17	58,61	59,91	58,88	59,66	59,14	59,40	59,40	84
85	61,14	59,05	60,89	59,31	60,63	59,58	60,37	59,84	60,10	60,10	85
86	61,86	59,74	61,60	60,01	61,34	60,28	61,08	60,55	60,81	60,81	86
87	62,58	60,44	62,32	60,71	62,05	60,98	61,79	61,25	61,52	61,52	87
88	63,30	61,13	63,03	61,41	62,77	61,68	62,50	61,95	62,23	62,23	88
89	64,02	61,82	63,75	62,10	63,48	62,38	63,21	62,66	62,93	62,93	89
90	64,74	62,52	64,47	62,80	64,19	63,08	63,92	63,36	63,64	63,64	90
91	65,46	63,21	65,18	63,50	64,91	63,78	64,63	64,07	64,35	64,35	91
92	66,18	63,91	65,90	64,20	65,62	64,48	65,34	64,77	65,05	65,05	92
93	66,90	64,60	66,62	64,89	66,33	65,18	66,05	65,47	65,76	65,76	93
94	67,62	65,30	67,33	65,59	67,05	65,89	66,76	66,18	66,47	66,47	94
95	68,34	65,99	68,05	66,29	67,76	66,59	67,47	66,88	67,18	67,18	95
96	69,06	66,69	68,76	66,99	68,47	67,29	68,18	67,59	67,88	67,88	96
97	69,78	67,38	69,48	67,69	69,19	67,99	68,89	68,29	68,59	68,59	97
98	70,50	68,08	70,20	68,38	69,90	68,69	69,60	68,99	69,30	69,30	98
99	71,21	68,77	70,91	69,08	70,61	69,39	70,31	69,70	70,00	70,00	99
100	71,93	69,47	71,63	69,78	71,33	70,09	71,02	70,40	70,71	70,71	100
Dist.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat.	Dep.	Lat	Dep.	Lat.	Dist.
	46 Deg.		45¾ Deg.		45½ Deg.		45¼ Deg.		45 Deg.		

F I N I S.

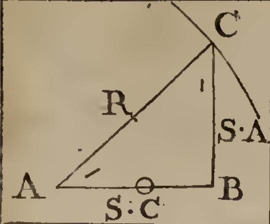






Jas. Basire sculp.

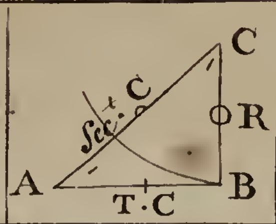
The Proportions for the Solution of 6 Cases of Right Angled Plane Triangles.



Case 1.

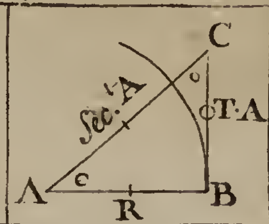
R:AC::SA:BC

R:AC::SC:AB



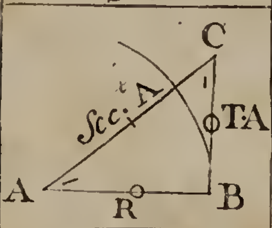
TC:AB::R:BC

TC:AB::Sec.^{t}C:AC



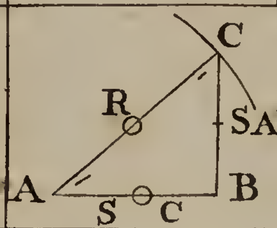
AB:R::AC:Sec.^{t}A

R:AB::TA:BC



Sec.^{t}A:AC::R:AB

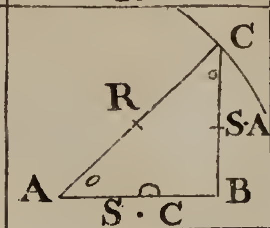
Sec.^{t}A:AC::TA:BC



Case 3.

SA:BC::R:AC

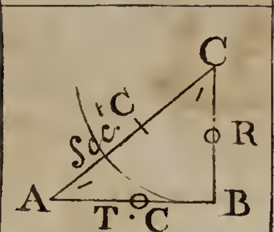
SA:BC::SC:AB



Case 5.

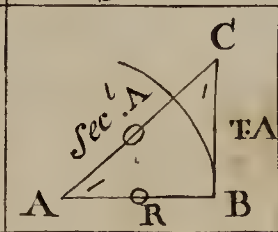
AC:R::BC:SA

R:AC::S.C:AB



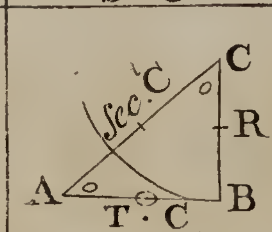
Sec.^{t}C:AC::R:BC

Sec.^{t}C:AC::TC:AB



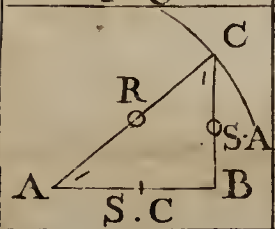
TA:BC::R:AB

TA:BC::Sec.^{t}A:AC



BC:R::AC:Sec.^{t}C

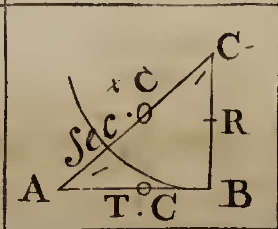
R:BC::T.C:AB



Case 2.

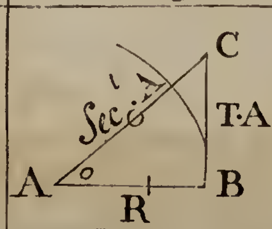
S.C:AB::R:AC

S.C:AB::SA:BC



R:BC::TC:AB

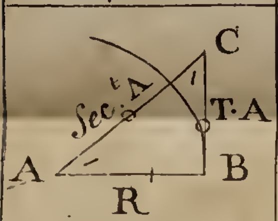
R:BC::Sec.^{t}C:AC



Case 6.

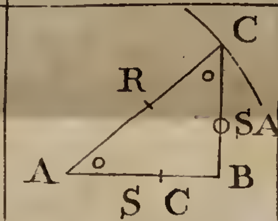
AB:R::BC:TA

R:AB::Sec.^{t}A:AC



R:AB::TA:BC

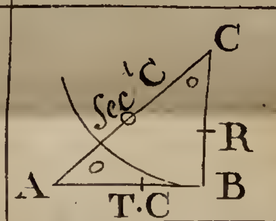
R:AB::Sec.^{t}A:AC



Case 4.

AC:R::AB:S·C

R:AC::SA:BC

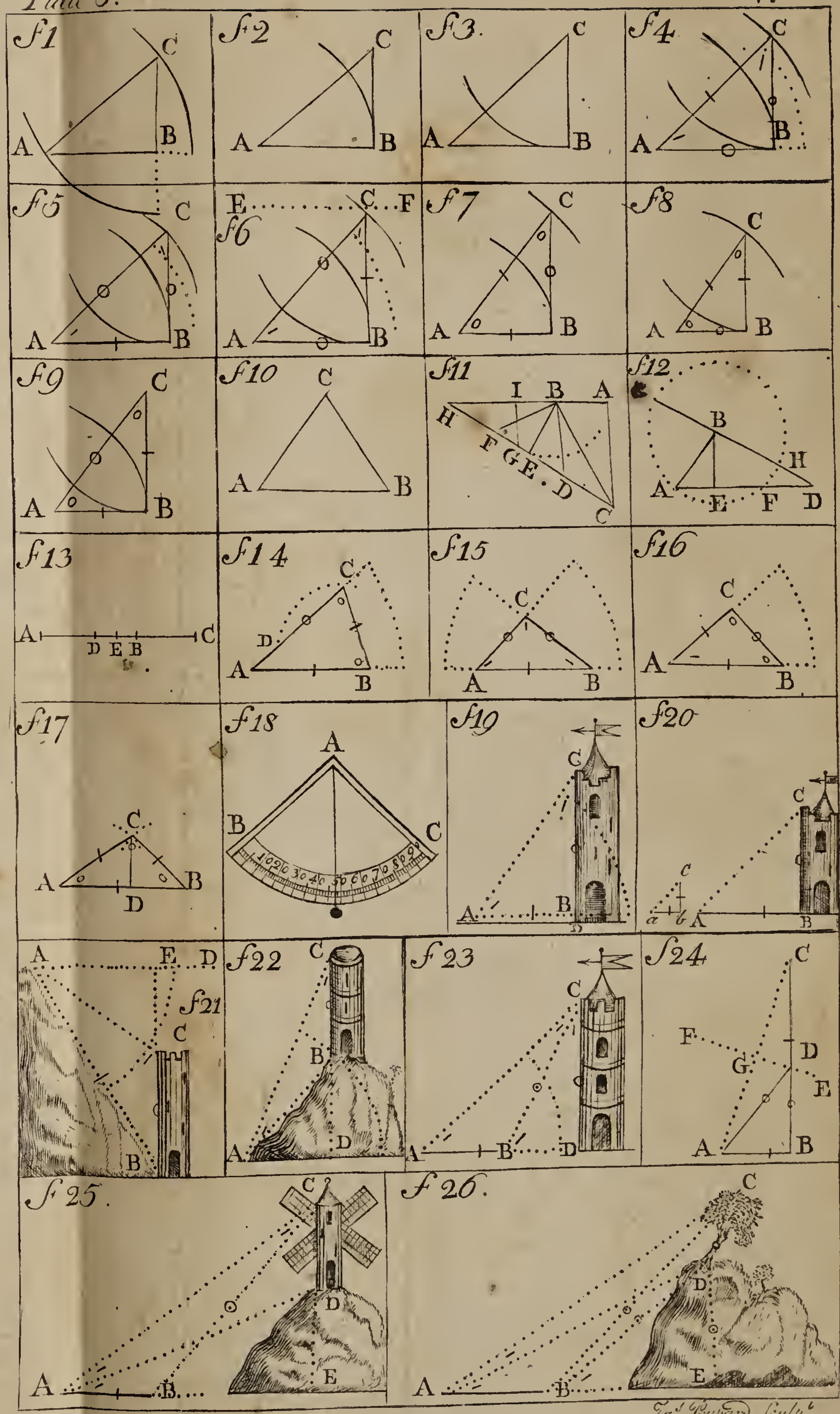


BC:R::AB:T.C

R:BC::Sec.^{t}C:AC

Ja.s Seward sculp.t

Plate 5. V.



Ja.s Bryant sculp.t

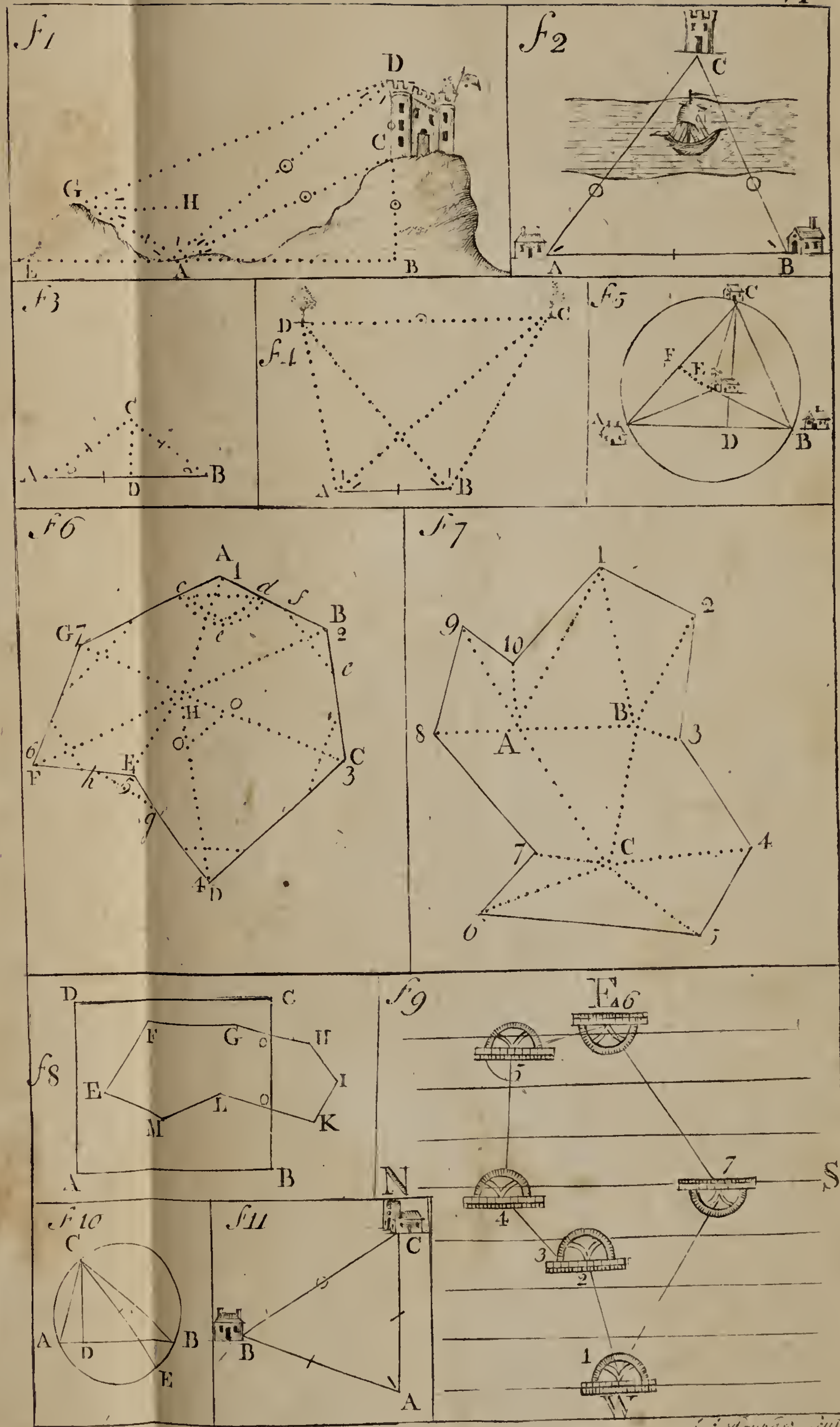
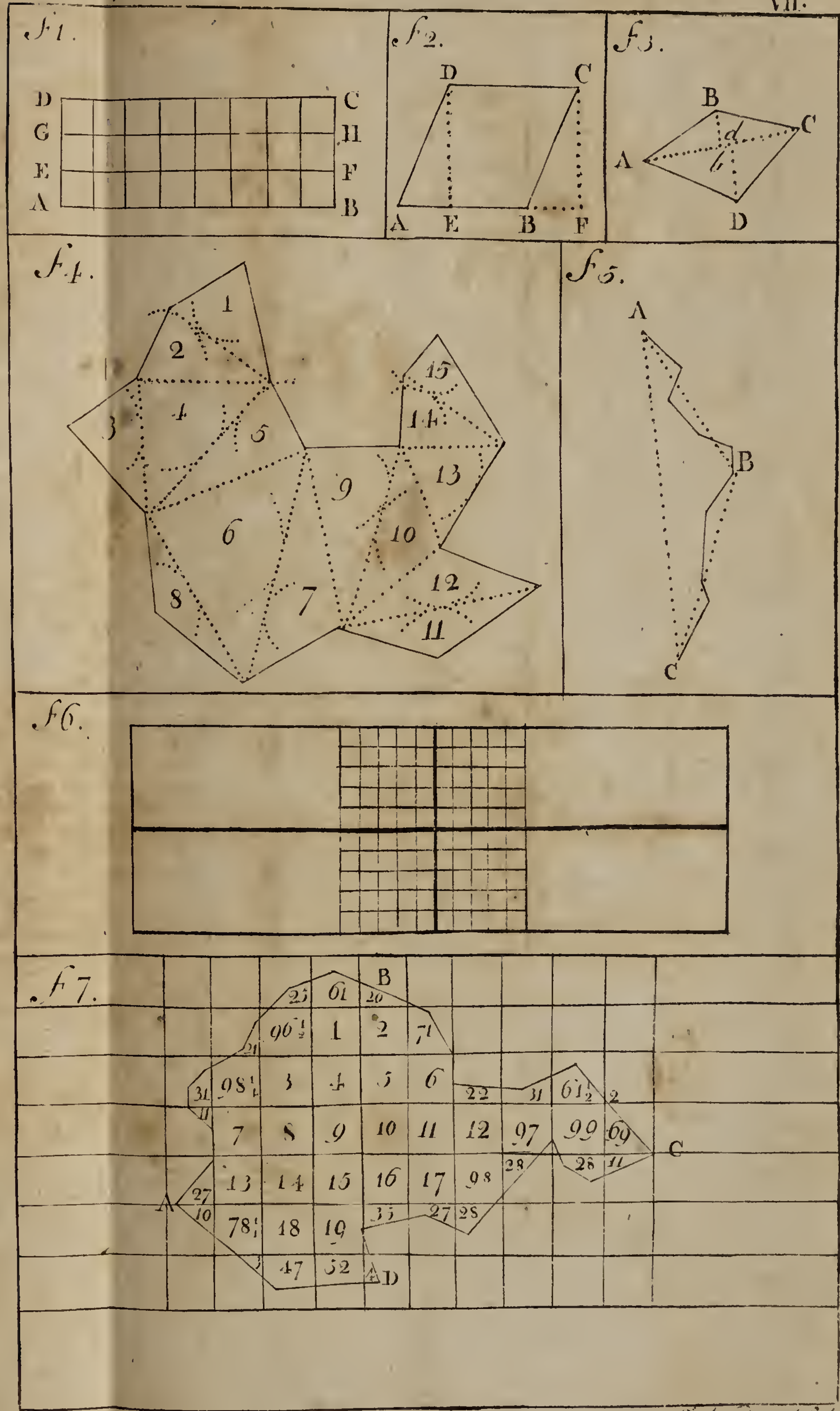
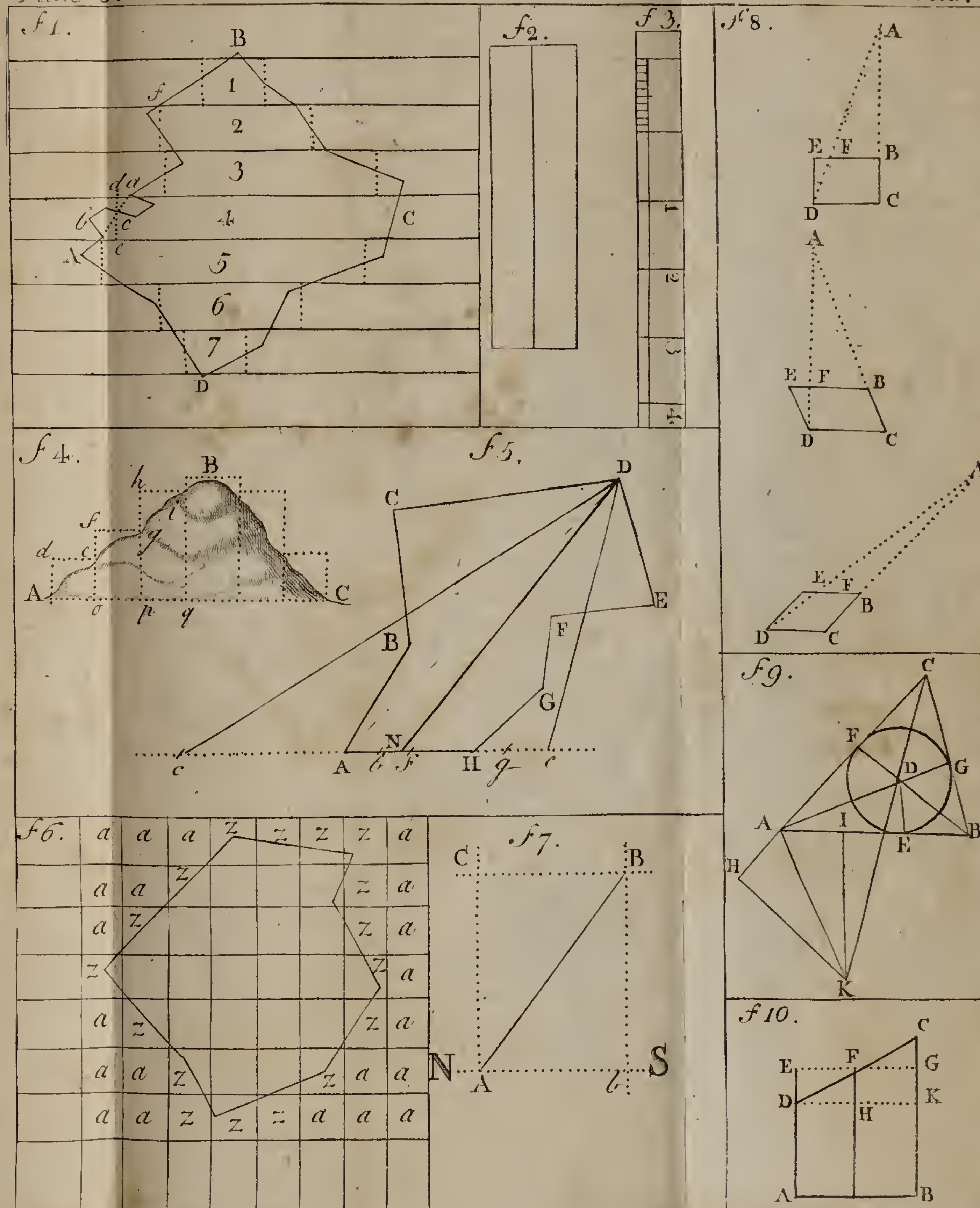
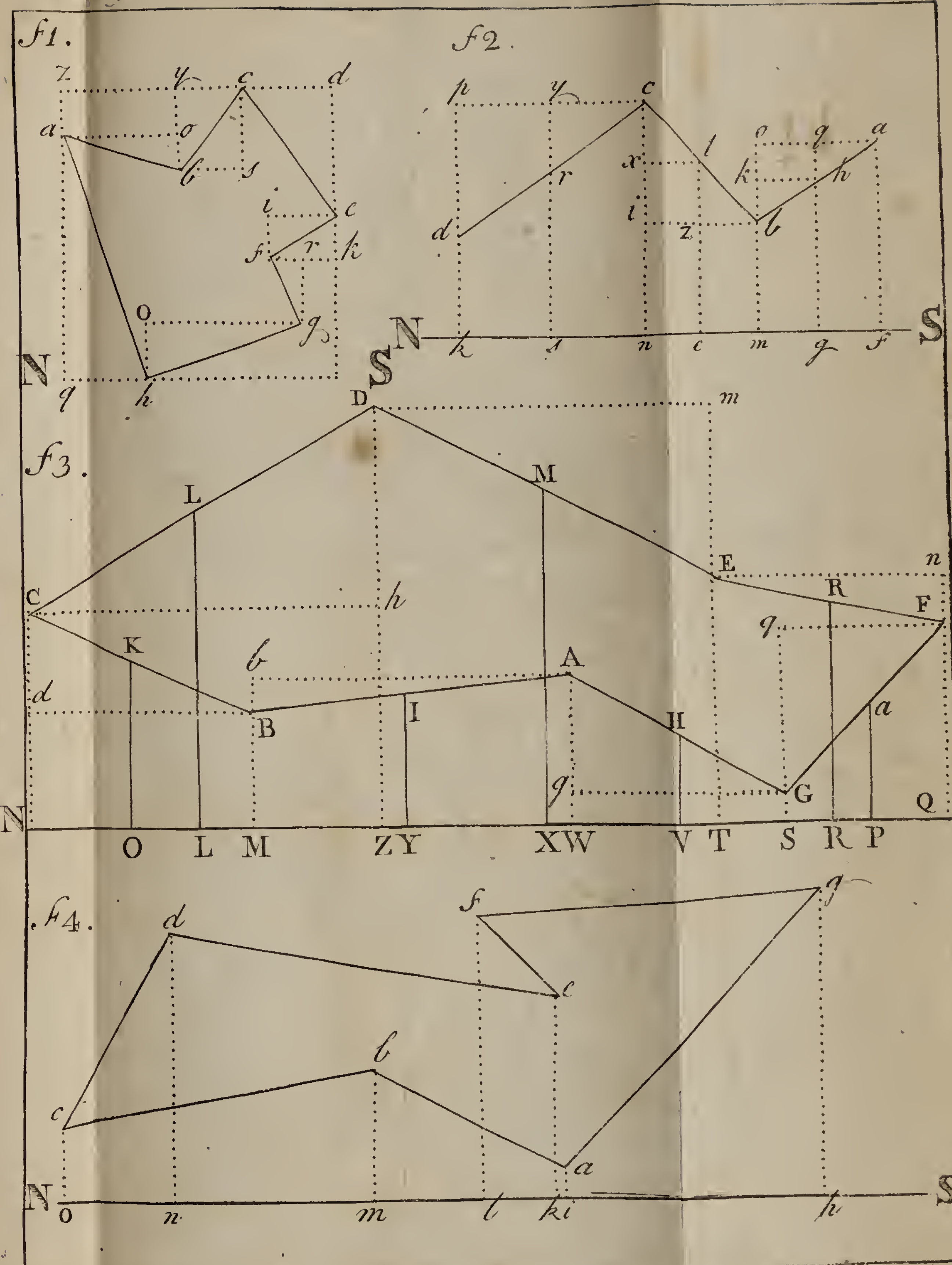

f1
f2
f3
f4
f5
f6
f7
f8
f9
f10
f11
N
S

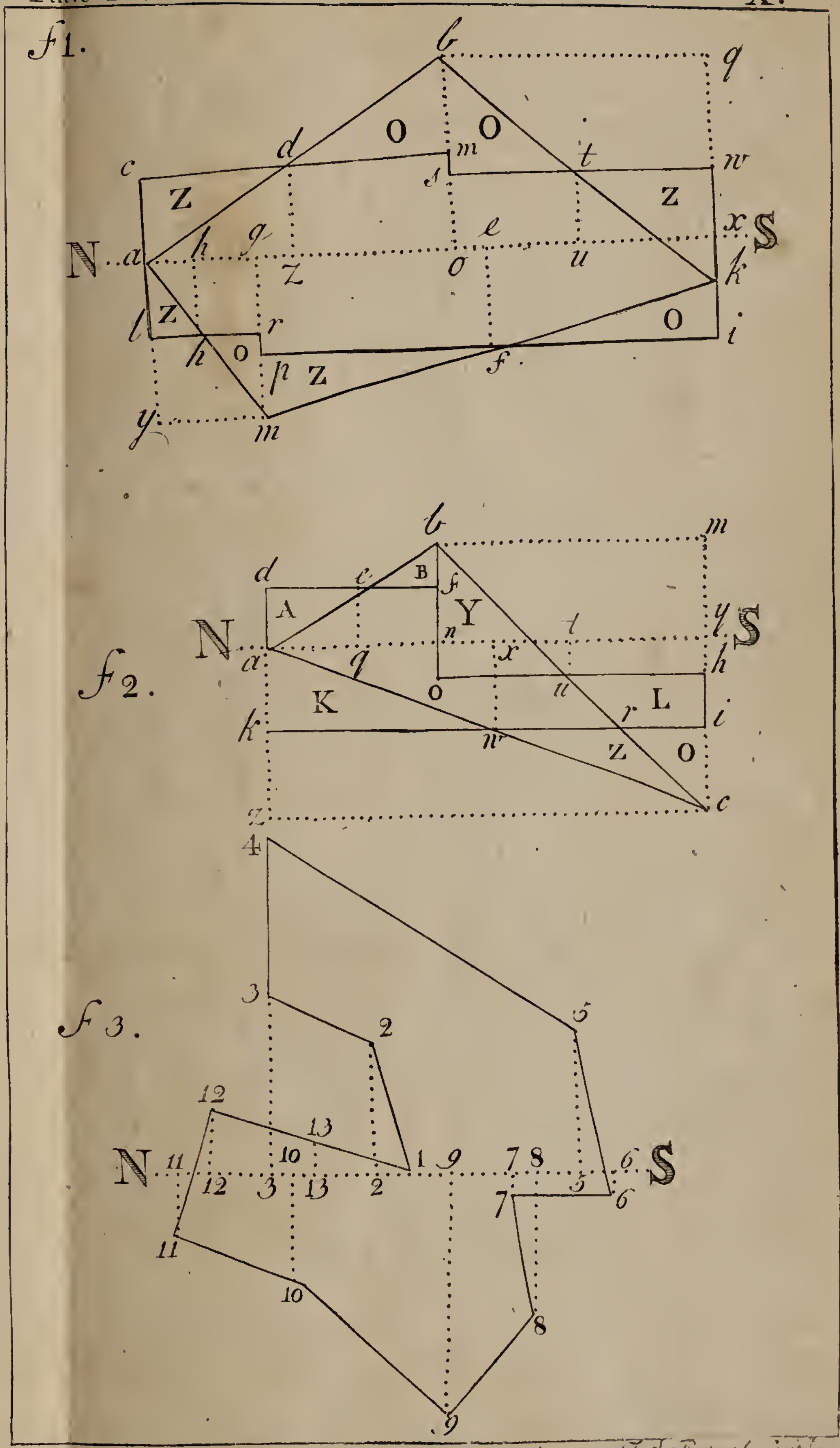
Plate 7.

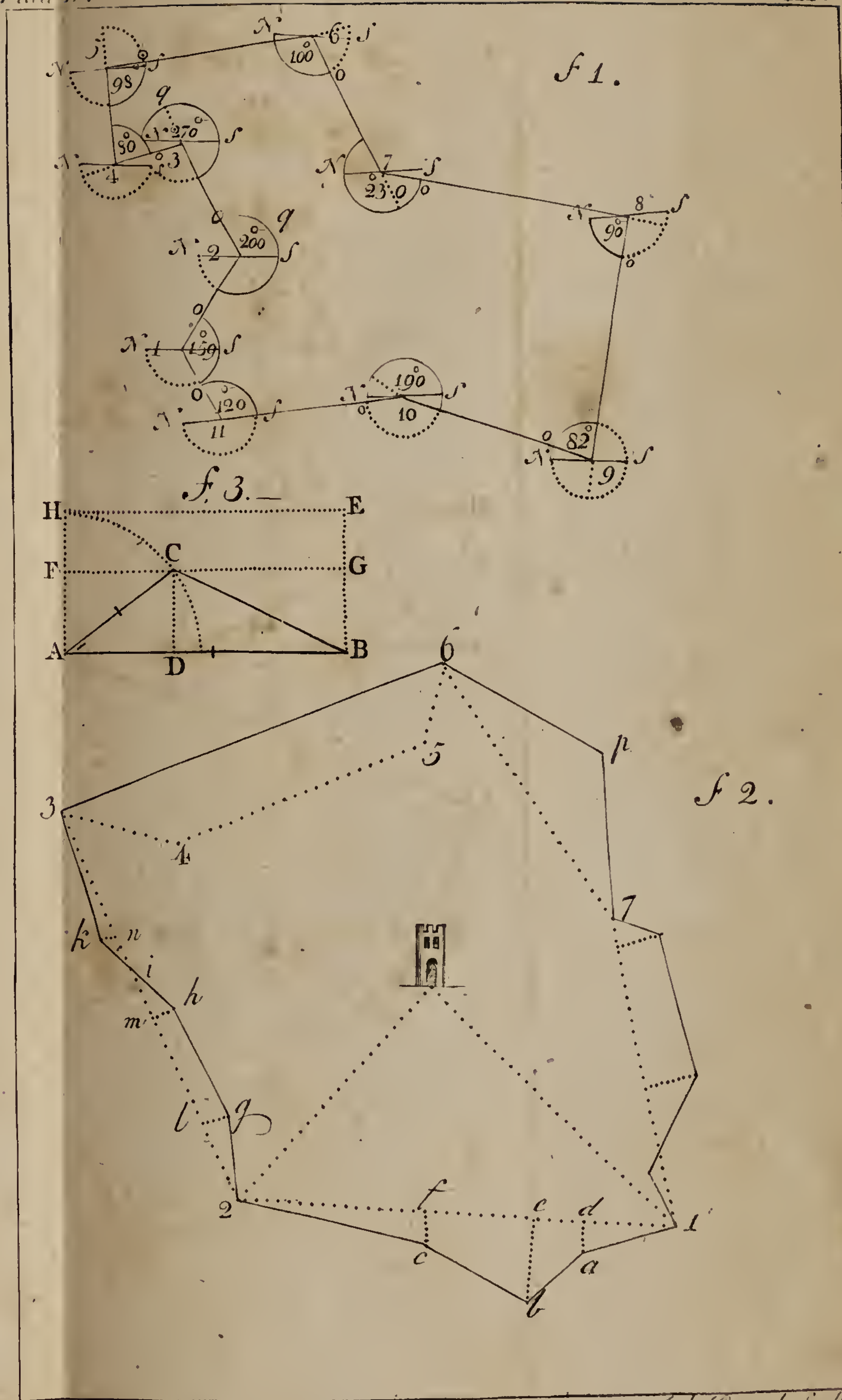


Ja.s Poynard sculp.


f 1.
f 2.
f 3.
f 8.
f 4.
f 5.
f 6.
f 7.
f 9.
f 10.
N
S


f1.
f2.
f3.
f4.


f1.
N
S
f2.
N
S
f3.
N
S


f 1.
f 3.
H
E
C
F
G
A
D
B
f 2.